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ANALYSIS OF TSCA SECTION 8(a)
SMALL MANUFACTURER EXEMPTION

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Contract No. 68-01-6287
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16. ABSTRACT

This report presents analyses in support of EPA's development of a small manufacturer definition required for Section 8(a) of the Toxic Substances Control Act. Under Section 8(a), manufacturers designated as "small" are exempt from certain reporting requirements. The report develops a framework for balancing off reporting costs with the benefits of receiving information from manufacturers. Production data are used in examples of how this balancing of costs and benefits can be performed for various types of small manufacturer definitions.

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PREFACE

The attached document is a contractor's study done with the supervision and review of the Office of Pesticides and Toxic Substances of the U.S. Environmental Protection Agency. The purpose of the study is to provide support of EPA's development of a small manufacturers definition required for Section 8(a) of the Toxic Substances Control Act (TSCA).

This report is being released and circulated before publication in the Federal Register of a proposed rule defining small manufacturers for reporting purposes under Section 8(a) of TSCA. The study is not an official EPA publication. It will be considered along with any comments received by EPA before or during the proposed rulemaking proceedings in establishing the final rule. Prior to final promulgation of the final small business definition, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the view of the contractor who performed the study.

EXECUTIVE SUMMARY

This report presents analyses in support of EPA's development of a small manufacturers definition required for Section 8(a) of the Toxic Substances Control Act. EPA provided production data for over 1,400 chemicals and sales and employment data on the over 3,000 locations at which the chemicals are manufactured. These data were used to estimate the amount of information that EPA would receive for Section 8(a) reporting rules under various small manufacturer definitions.

Four proxies are used to indicate the "amount of information" EPA would receive:

- Number of reports required to be prepared;
- Number of locations required to report;
- Percent of total production covered by the reporting requirement; and
- Percent of the chemicals for which sufficient information is received.

How these proxies vary as a function of the parameters of the definition is described.

A proxy for total cost to industry is also used. Total cost for various small manufacturer exemptions is indicated by the sum of the number of locations that have to report and the total number of reports that have to be prepared. How this proxy for total cost varies with the parameters of the definition is also described.

The analysis investigates two sets of parameters: (1) the annual production at a location of the chemical upon which a report is required (in kilograms) and the annual sales of the parent firm of the location; and (2) the annual production at a location of the chemical upon which a report is required (in kilograms) and the total employment at the parent firm of the location. Additionally, two structures of the exemption are considered; one for which locations must be below both parameters to be exempted, and the second for which locations need only be below one parameter to be exempted.

The results of the analysis indicate that an exemption based on annual sales and production quantity which requires locations to be below both parameters to be exempt, is preferred to the other exemption structures

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examined. Requiring locations to be below both parameters more accurately targets reductions in reporting costs to small manufacturers. Total employment was found not to be a good substitute for annual sales as an indicator of firms' abilities to absorb reporting costs.

The choice of the level of the exemption requires judgments about the relative value of obtaining different types of information from various segments of the chemical industry. These valuations must be balanced off against the cost to industry of providing the information. This cost (in dollars), will depend on the information requested in the rule. Therefore, an optimum exemption level has not been defined. Rather, this report identifies the tradeoffs between information and cost which occur at different exemption levels. EPA can use this information to identify appropriate exemption levels for the types of information it expects to require in future Section 8(a) rules.

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1. INTRODUCTION

The Toxic Substances Control Act (TSCA) authorizes EPA to develop or obtain data on new and existing chemical substances. Section 8 of the Act empowers the Administrator to require manufacturers, processors, and certain other persons to collect, retain, and/or report certain information. The Act also requires that EPA exempt small manufacturers from Section 8(a) reporting and recordkeeping rules. This report analyzes how small manufacturers should be defined for the purpose of this Section 8(a) exemption.

Ideally, the small manufacturer exemption should balance the benefits and costs of obtaining information. To attempt this balance, we developed a framework for evaluating the "benefits" and "costs" of various levels of small manufacturer exemptions.

Balancing of benefits and costs must take place in the context of expected future Section 8(a) rules. The marginal value of obtaining incremental amounts of information may vary with the type of information reported and the purpose for which it is being collected. One of the proxies for "benefits" may be more appropriately applied to evaluate some types of future rules than other proxies. Therefore, we examined expected future Section 8(a) rules to assess which of the proxies are most appropriate to use to evaluate the benefit of the information expected to be received by EPA under the future rules.

Having considered the expected Section 8(a) rules in the context of the framework, we evaluate the options for the small manufacturer exemption. This evaluation is aided by data analyses performed on 19,485 reports of production of 1459 chemicals by 3044 manufacturing locations. The data analyses describe how the proxies vary under different exemptions. The examination of exemption options included:

- The number and type of parameters for the exemption;
- The structure of the exemption, one-level or multi-level; and
- The level of the exemption itself, i.e., at what values should the chosen parameters be set.

The remainder of this report is divided into five chapters:

2. Framework for Analysis;
3. Future Section 8(a) Rules;
4. Data Analysis;
5. Analysis of Options; and
6. Conclusions.

2. FRAMEWORK FOR ANALYSIS

2.1 INTRODUCTION

Ideally, the small manufacturer definition should balance the costs and benefits of obtaining information. The "marginal benefit" of obtaining information is an elusive concept, and in this case, its estimation is complicated by the fact that the purposes for obtaining the information are as yet not fully identified. For example, if information were collected to estimate the magnitude of annual production of certain chemicals, information from a large number of small firms that account for less than ten percent of total production would not be very valuable. However, if information were collected to identify the total number of sites producing certain chemicals, then information on even small producers could be needed.

To address this problem, four proxies for "benefit" are used:

- Number of reports required to be prepared;
- Number of locations required to report;
- Percent of total production covered by the reporting requirement; and
- Percent of the chemicals for which sufficient information is received.

To balance the "benefits" and "costs" of different rules, a proxy for cost was also developed. The total cost to industry of a reporting rule is a function of the number of reports that must be prepared, the number of sites at which the reports are prepared, and possibly the number of parent firms to which the sites belong. The actual cost in dollars will depend on the complexity of the rule and the type of information requested. Generally, however, the greater the number of reports, sites, and possibly firms, the greater the cost of the rule.

Each of the proxies is discussed below.

2.2 ESTIMATING BENEFITS

Four proxies will be used to evaluate the relative benefit of exempting fewer, as opposed to a larger number of small manufacturers from having to report under Section 8(a). The proxies themselves do not strictly measure "benefits." Instead, they measure the relative amounts of different types of information required to be reported under various small manufacturer exemptions. The amounts of information received must be valued relative to each other in order to have a final benefit measure. We have not assigned values to the different types of information, although we have speculated regarding potential future Section 8(a) rules to determine which types of information, i.e., which proxies, may be most appropriate to use to evaluate them. This assessment of future Section 8(a) rules is in Chapter 3 of this report.

Each of the proxies for benefits is described below.

Reports. The number of reports that would have to be prepared can be used as a proxy for the amount of information received under a given small manufacturer exemption. The assumption is that the greater the number of reports received, the more is learned about the chemicals' annual production, uses, or whatever type of information is requested. The marginal value of receiving reports from "small manufacturers" may not be high if small manufacturers are not able to furnish new information about chemicals that large manufacturers cannot also provide. Therefore, although the marginal value of additional reports may vary, generally, the greater the number of reports prepared, the greater the "benefits" of the rule.

The number of reports that are required to be prepared under a given small manufacturer exemption has meaning only in relation to the maximum possible number of reports that would be required if there were no exemption. The percentage of total possible reports that must be prepared measures the information received in relation to the maximum possible amount of information. The percentage of total possible reports that is not prepared under a given exemption measures the amount of information not received relative to the maximum possible. This last measure, percentage of total possible reports not prepared, is used as a proxy for the amount of information received under various small manufacturer exemptions. The greater the value of this proxy, the less information is received.

Locations. The number of locations that would have to prepare reports is the second proxy for benefit. In a situation in which information is requested on only one chemical, the reports and locations proxies are identical; each location that produces the chemical can submit one report. When information is obtained on a group of chemicals, which is the primary focus here, the proxies diverge because a single location may submit any number of reports. A small percentage of locations may account for a large percentage of reports. Therefore, both proxies are examined.

The greater the number of locations that must report, the more comprehensive the information received. The marginal value of obtaining information about even "small manufacturers" may be high if the purpose of the rule is to identify all the locations. The assumption is that for many toxic chemicals, comprehensive reporting may be necessary.

As with the "reports" proxy, the number of locations required to report has meaning only in relation to the total number of locations that would have to report were there no exemption. Therefore, a percentage measure is used; the percentage of total possible locations not required to report. The greater the value of this proxy, the less information is received.

Production. Amount of production is the third proxy for benefit. The greater the amount of production covered, the more comprehensive the reporting requirement. For example, if a Section 8(a) rule were designed to identify opportunities for environmental releases and human exposure by requiring the reporting of information on the uses and disposal methods of chemical substances, then the amount of total production covered would indicate the extent to which the information obtained was complete. Again, a percentage measure is used; the percentage of total possible production not covered by the reporting rule. The greater the value of this proxy, the less information is received.

Chemicals. The final proxy for benefit is the number of chemicals for which insufficient information is reported. The production proxy measures how much of the total production for a group of chemicals is covered. However, it gives no indication of whether some chemicals are missed; i.e., needed information is not received for them at all. This proxy measures the percentage of chemicals about which insufficient information is obtained under various small manufacturer exemptions.

"Sufficient information" can be defined for this proxy in various ways, including:

- cover a given percentage of total production of the chemical; and
- cover a given percentage of the locations that produce the chemical.

For simplicity, we defined sufficient information about a chemical as having at least one location report on it. Therefore, this proxy measures the percentage of the total number of chemicals that are missed entirely.

These four proxies--reports, locations, production, and chemicals--make up the framework for evaluating the benefits of requiring various amounts of information to be reported. Their use and interpretation vary with the types of reporting rules to which they are applied. The next section discusses proxies for costs.

2.3 ESTIMATING COSTS

To balance the "benefits" and "costs" of different rules, a proxy for cost is needed. The total cost to industry of a reporting rule is a function of the number of reports that must be prepared, the number of locations at which the reports are prepared, and possibly the number of parent firms to which the sites belong. The actual cost in dollars will depend on the complexity of the rule and the type of information requested. Generally, however, the greater the number of reports, locations, and possibly firms, the greater the cost of the rule.

The total cost of the rule can be divided into two parts: "fixed cost" and "variable cost." The fixed cost refers to the resources of the location and firm required to become familiar with the reporting requirements. We have assumed that this cost is wholly borne by locations that actually have to report. Therefore, for purposes of our analysis, the fixed cost of reporting is indicated by the number of locations required to report.

It is not evident how much involvement the parent firm will have in the reporting procedure. If, for instance, the reports are cleared through the parent company, additional costs will be incurred there. If these resources are constant for each additional location controlled by one company, this cost will be captured in the number of locations. However, if a firm must incur a fixed cost regardless of how many locations it controls, the number of parent firms should be a separate parameter in the cost equation.

The variable cost refers to the cost per report prepared. This includes collecting the data on each chemical and filling out the form. For each additional report that a site prepares, it bears an additional cost. Therefore, the total number of reports prepared is an indicator of the variable costs of reporting.

Because the total cost to industry is a function of the cost at the location and/or firm and the cost per report prepared, we set up the following equation:

$$\text{Total Cost} = (\underline{a})\,(\text{Number of Firms}) + (\underline{b})\,(\text{Number of Locations}) + (\underline{c})\,(\text{Number of Reports}).$$

If the parent firm is not involved in the reporting, $a = 0$ and the equation becomes:

$$\text{Total Cost} = (\underline{b})\,(\text{Number of Locations}) + (\underline{c})\,(\text{Number of Reports}).$$

To estimate the coefficients $\underline{b}$ and $\underline{c}$, we reviewed estimates of fixed costs and variable costs of reporting for two different EPA rules. The first estimate, for the inventory reporting rule where the manufacturers were required to report production volume, set fixed costs at \$300 per location and variable costs at \$100 per report.[1] The second estimate was for the proposed Section 8(a) Preliminary Assessment Information Rule (discussed in Chapter 3). Under this rule, the manufacturer provides more information about each chemical and this is reflected in the higher estimate for variable costs (\$420 per report). The fixed costs for this rule were estimated at \$480 per site.

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[1] A.D. Little, Analysis of Options for Definition of Small Business and Estimated Cost of the Initial Section 8(a) Reporting Requirements (Cambridge, MA; November 1977).

Of the two rules, we assume the costs for future Section 8(a) rules will be closer to those estimated for the Preliminary Assessment Information Rule. Therefore, given the information available, the best values for the coefficients are $\underline{a} = 0$, $\underline{b} = 8$, and $\underline{c} = 7$. To facilitate the analysis, we set $\underline{a} = 0$, $\underline{b} = 1$, and $\underline{c} = 1$, and the proxy for cost becomes simply the number of reports prepared plus the number of locations reporting. This is neither a conservative nor a non-conservative assumption regarding costs because the actual cost in dollars is not addressed in the analysis. Only the shape of the cost curve (as a function of the exemption parameters) is affected by the coefficients, and the sensitivity of the results to the choice of coefficients is examined in Section 4.2.

The next chapter assesses future Section 8(a) rules in the context of the framework described in this chapter.

3. FUTURE 8(a) RULES

3.1 INTRODUCTION

The language of Section 8(a) of TSCA is very broad. The EPA Administrator may require manufacturers to maintain records or submit reports as necessary for the effective enforcement of the Act. The types of 8(a) rules may vary from requiring general information about many chemicals to requiring very detailed information about a small number of chemicals.

Small manufacturers and processors are not subject to Section 8(a) reporting and recordkeeping unless this is specifically required by a rule promulgated by the Administrator when:

- a chemical is subject to a testing rule under Section 4;
- the Administrator rules that a chemical may present an unreasonable risk of injury to health or the environment under Section 5(b)(4);
- additional information is required by the Administrator during the premanufacturing notification (PMN) review process in order to decide whether to regulate a new chemical under Section 5(e);
- a chemical is subject to a control action under Section 6; or
- a chemical is the subject of litigation under civil action provided for in Section 5 or 7.

For other types of actions, small manufacturers and processors are exempt. Section 8(a)(3)(B) requires the Administrator to prescribe standards for determining which manufacturers and processors qualify for this exemption.

EPA is considering proposing a general small manufacturers exemption to apply for all Section 8(a) rules unless the chemical substance or mixture is the subject of rules outlined above.[1] The possible variation in the scope and level of detail of 8(a) rules complicates the selection of a general exemption for small manufacturers. An exemption set at a level to achieve very detailed information in one rule might be too inclusive for another rule, resulting in more reporting than necessary for the purposes of the rule, and unnecessarily increasing the cost to industry. For the purpose of this study, we have speculated about the kind of rules that might be used.

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[1] 45 FR 66180, 10/6/80.

This chapter examines two types of potential future rules: group chemical rules and individual chemical rules. Group chemical rules may be used to obtain general information, not available from public sources, regarding a large number of chemicals. These data may be useful for evaluating potential hazards, for setting priorities for further investigation, or for other purposes. An individual chemical rule may be used to obtain detailed information about a particular chemical that is not available from public sources. This information may be useful for evaluating risks and potential risk reduction options.

These potential rules illustrate the kind of information manufacturers may have to report in future 8(a) actions. We briefly examine these rules with the proxies for information that were developed for this analysis and discuss which of the proxies is the most appropriate to use to evaluate the benefits of information received under each rule.

3.2 GROUP CHEMICAL RULES

Group chemical rules may require manufacturers to report general information such as that regarding production processes, exposure potential, and consumer uses. Chemicals could be selected for such a rule on the basis of potentially significant toxicity and the unavailability of the needed information from public sources.

To determine which of the "value of information received" proxies is most appropate for defining small manufacturers for group chemical rules, a more precise understanding of the potential rule is required. For purposes of this analysis we shall assume the following:

- The primary purpose of a group chemical rule would be to aid in the setting of priorities for further investigation.
- The information received on each chemical in a group chemical rule should be representative (to the extent possible) of all of its potential risks (i.e., representative of the various manufacturing processes, uses, and disposal problems).
- The Agency could tolerate not receiving sufficient information on a limited number of chemicals in the group chemical rule assuming that the Agency has the means and the opportunity to supplement the information received with data from other sources. Alternatively, in some cases the lack of reported data may indicate that the chemical is of little concern (e.g., it is only produced in very small quantities and therefore all of its manufacturers were not required to report) so that additional investigation is not required.

The "chemicals missed" proxy is of obvious importance in evaluating this type of rule. Clearly, the fewer chemicals missed the better, and this proxy allows EPA to set a small manufacturer exemption to minimize, for a given cost to industry, the number of chemicals for which no reports would be received. However, this approach could also lead to an unnecessary increase in the total cost to industry of the reporting rule. A balance is required between the additional cost to the Agency of filling in data on missed chemicals and the additional reporting cost imposed on industry in order to reduce the number of chemicals missed. Therefore, to make full use of the chemicals missed proxy, information is required on what steps the Agency would take (if any) to obtain information on chemicals missed by the rule, and what the cost of those steps would be. For example, in a given range of small manufacturer definitions, missing a chemical may indicate that the chemical is of too little importance to be considered further. This could occur if the exemption were structured such that a chemical could be missed only if it were produced in very small quantities. In this case the Agency may not be very interested in any chemicals that were missed, and it would not take steps to fill in data on the missed chemicals. Therefore, in this example, the chemicals missed proxy would not be appropriate for evaluating the value of information received because there would be very little incremental value of missing fewer chemicals. How few chemicals are missed is a judgment for EPA to make based on the value of the information received and the costs to industry of providing such data.

The percentage of production covered proxy could indicate the extent to which all uses of the chemicals are covered. If a large portion of total production is covered, it may also be likely that most uses would also be covered. However, this proxy is biased toward large production processes. Therefore, relying on this proxy may lead to not receiving sufficient information on manufacturing processes of various sizes. This lack of coverage of manufacturing processes could be an important deficiency if processes of various sizes have different exposure potentials, or if manufacturers of smaller quantities tend to supply different uses than manufacturers of larger quantities.

The production process used by a firm for a particular chemical may be a function of the size of the firm (as measured by annual sales) and the production volume of the chemical. The data do not indicate that small quantities of chemicals are produced only by locations with lower sales and fewer employees. Forty-one percent of the reports of chemical production listed in the lowest production category (less than one-thousand pounds) are attributable to manufacturers in the largest sales category (over $100 million). While it can be seen that large companies, in many cases, produce small volume chemicals, it is not known how the production processes used by those firms compare to the processes used for the same chemicals produced in similar quantities by smaller firms. Authoritative information outlining the extent to which production processes and equipment vary across segments of the chemical industry is not readily available. It is believed, however, that the potential is very great; in particular if systematic differences exist in the age and type of equipment used, and disposal methods employed. This may be due, in part, to variances in the availability of capital across segments of the industry.

To the extent that these systematic variances do occur, the exposure potentials from different segments of the industry may also vary, and information from "large manufacturers" may not be applicable for extrapolation to describe "small manufacturers." To ensure that sufficient information is obtained on all segments of manufacturers, the information proxies could be evaluated on the basis of their ability to provide reports across both production level and firm size. However, if production processes and equipment do not vary systematically throughout the industry, then representativeness across all the production and sales categories may not be an important criterion to consider. Due to its potential for importance, representativeness is used in the analysis below to illustrate the effect it may have on the choice of the small manufacturer exemption.

Both the reports and locations proxies may be useful for evaluating group chemical rules. They are both neutral to the representativeness problem in that neither of them is biased in its construction. However, in using them to help choose a particular level for the exemption, the representativeness of the information that would be received as a result of maximizing one or the other proxies for a given cost should be examined. This is discussed more fully in Chapter 5.

3.3 INDIVIDUAL CHEMICAL RULES

While future 8(a) reporting may include group rules, these rules are not in place. Several rules have been prepared for individual chemicals.

PBB/Tris. This final 8(a) rule[2] requires chemical manufacturers and importers with sales above $500,000 to report any manufacture or import of polybrominated biphenyls (PBBs) or tris (2,3-dibromopropyl) phosphate. All companies which manufacture or import more than 10,000 pounds per year must report.

While both of these chemicals are toxic, they are both apparently out of production. Section 6 action is not currently contemplated. A reporting rule gives EPA notice of the resumption of production and a chance to initiate action if it determines that an unreasonable risk exists at that time.

Asbestos. This proposed 8(a) rule would require manufacturers, importers and processors of asbestos to report information about activities involving use of and exposure to asbestos.[3] The rule was proposed because the information available from other agencies is limited in various ways. For instance, the Bureau of Mines estimated that information from its asbestos consumption figures is accurate to only ± 50 percent. Much of the information from other agencies is not available because of confidentiality restrictions.

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[2] 45 FR 70728, 10/24/80.

[3] 46 FR 8200, 1/26/81.

Although it has not proposed any such action, EPA might use Section 8(a) authority for requiring reporting on new chemicals as a supplement to the reporting required under the PMN process. This reporting would be used to obtain more information on production, use, exposure and available test data for a new chemical which did not warrant regulation based on its PMN submission.[4] An alternative method of obtaining some of this information is through Section 5(a)(1)(B) significant new use authority.

All of these proposed or anticipated single chemical rules are collecting information for assessment purposes. The information will be used to decide whether to take further action and if so, what type of action to take.

The chemicals missed proxy is not relevant to individual chemical rules. The proxy could be interpreted as the percent chance that a randomly selected chemical (from the chemicals included in the data used in this report) would be missed. However, it is likely that preliminary investigations by the Agency would be sufficient to identify whether adequate reports would be received on a particular substance that was the subject of an individual chemical rule.

The production proxy is biased toward large production processes, as was discussed above in relation to group chemical rules. For an individual chemical, this production proxy may be an adequate measure of the information received under a given reporting rule. However, it is not possible to generalize regarding its application for evaluating all future individual chemical rules.

For individual chemical rules the reports received and locations reporting proxies are equivalent. The appropriate level at which to set the exemption will depend on the type of information requested under the rule. Nevertheless, in general there appears to be no reason to believe that the exemption level for individual chemical rules should differ substantially from the exemption level for group chemical rules.

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[4] Office of Toxic Substances, U.S. Environmental Protection Agency, Priorities for OTS Operation (January 1982), pp. III-12 and III-13.

4. DATA ANALYSIS

4.1 INTRODUCTION

To analyze the options for setting the small manufacturer exemption, we analyzed data on over 3,000 manufacturing locations of over 1,400 different chemicals. EPA provided sales, employment, and production data specific to each location and production data specific to each chemical. This information was obtained by EPA from the TSCA Chemical Substance Inventory and Dun and Bradstreet, Incorporated. Because a significant portion of the sales and employment data was incomplete, we supplemented the information provided by EPA by manually searching through reference materials for missing sales and employment data. The final data base included 3,044 manufacturing locations of 1,459 chemicals. The data used in this report are described in Appendix A.

The data were used to estimate how the proxies for "benefits" and "costs" change for various small manufacturer exemptions. We calculated the percent of reports not prepared, percent of locations not required to report, percent of production not covered, and percent of chemicals missed entirely for combinations of two sets of parameters for the small manufacturer exemption:

- Total annual sales for the corporation and production quantity of individual chemicals at each manufacturing location; and
- Total employment for the corporation and production quantity of individual chemicals at each manufacturing location.

The percent of chemicals missed was estimated using a simulation that is described in Appendix B.

We also examined two structures of the exemption: one for which the location must be below both parameters in the set in order to be exempted, and the second for which the location need be below only one parameter in the set in order to be exempted. The choices of which parameters to use and how to structure the exemption are discussed in Chapter 5 of this report. The data analyses are described in Appendix B.

The results for the proxies for benefits and costs for small manufacturer exemptions with parameters of production quantity and sales are presented first. The values of the proxies are reported in matrix format (Exhibits 4-1 through 4-9), then they are graphed (Exhibits 4-10 through 4-18), and then the slopes of the graphs are reported in matrix format (Exhibits 4-19 through 4-27).

The values for the locations, reports, and production proxies are reported for both structures of the exemption: when the location must be below both parameters to be exempted, and when the location need only be below one parameter to be exempted. The percent of chemicals missed was only calculated for all the combinations of parameters for the case when the locations must be below both parameters in order to be exempted (see Appendix B for a full discussion of this analysis).

As a rough approximation for the percent of chemicals that would be missed if the locations were required to be below only one parameter to be exempted, we calculated the percentage of the chemicals whose highest report of production falls into each of the production quantity categories. The cumulative sum of these percentages is the lower bound on the percent of chemicals that would be missed as a function of the production quantity parameter alone, when locations need only be below one parameter to be exempted. These estimates, shown in Exhibit 4-28, reveal that a large percentage of chemicals would be missed for even low production quantity parameters when the locations need only be below one parameter in order to be exempted.

The results for the proxies for benefits and costs for small manufacturer exemptions with parameters of production quantity and employment are presented next. The values of the proxies are reported in matrix format (Exhibits 4-29 through 4-37), then they are graphed (Exhibits 4-38 through 4-46), and then the slopes of the graphs are reported in matrix format (Exhibits 4-47 through 4-55).

The values for the locations, reports, and production proxies are reported for both structures of the exemption: when the location must be below both parameters to be exempted, and when the location need only be below one parameter to be exempted. As mentioned above, the percent of chemicals missed was only calculated for the case when the location must be below both parameters in order to be exempted. An approximation of the percent of chemicals that would be missed if the locations were required to be below only one parameter to be exempted is shown in Exhibit 4-28.

Several observations and conclusions can be drawn regarding these proxies for benefits and costs. For example, Exhibit 4-5 shows that for the case when the locations must be below both parameters to be exempt, over 99 percent of total production is covered when the production parameter is set at or below 45.4 million kilograms (100 million pounds), and the sales parameter is set at or below 100 million dollars. Almost all production is covered for exemptions even in this high range because, predictably, large quantity chemicals make up nearly all production and locations with very large sales (or employment) produce nearly all the large quantity chemicals. This conclusion is borne out in Exhibit 4-6 which shows (in its top row) that locations with annual sales under 100 million dollars account for only 8.3 percent of total production. In the first column of Exhibit 4-6, we also see that only five percent of all production was reported in quantities under 22.7 million kilograms (50 million pounds). Therefore, if the small manufacturer exemption requires that locations be below both parameters in order to be exempted, then nearly all the production (of the chemicals in our data) would be covered if the parameters of the exemption were set within the range considered here. A significant portion of total production can be missed if locations need only be below one parameter to be exempt. The choice between these two structures for the definition is discussed in Chapter 5.

The behavior of the other proxies as a function of the parameters of the definition can also be analyzed from the results of the data analyses. In particular, the behavior of the benefit proxies relative to the behavior of the cost proxy is of interest. The remainder of this chapter discusses the relationships between the benefit and cost proxies and the effects that missing data and information held confidential may have on the results.

4.2 RELATIONSHIPS BETWEEN THE BENEFIT AND COST PROXIES

To examine the relationships between the benefit and cost proxies, the behavior of the various proxies as a function of the exemption parameters must first be determined. Isoquant curves, a convenient method for displaying information about the relationship among three variables, are presented here to facilitate this analysis. The employment parameter is not considered in this section because its effects on the level of information received are very similar to the effects of the sales parameter. Therefore, only isoquant curves showing the relationship between annual sales, production volume, and level of information received are included.

Exhibit 4-56 displays how sales and production volume trade off to maintain a constant number of locations reporting a measure of information obtained from the reporting rule. This exhibit was constructed for the case when locations must be below both parameters of the definition to be exempted. For a small manufacturer definition of less than $100 million in sales and 454,000 kilograms (1 million pounds) of production, approximately 15 percent of the locations would be exempted. Fifteen percent of the locations could also be exempted for the other combinations of sales and production that lie along the isoquant labeled 15 percent, e.g., $10 million and 227 million kilograms (500 million pounds). The fact that the number of locations stays the same does not mean that the information would be received from exactly the same manufacturers. For example, a location with annual sales of $40 million and production of 22,000 kilograms would not have to report under the $100 million, 454,000 kilogram definition. It would, however, have to report under the $10 million and 227 million kilogram definition.

The total cost to industry is represented in Exhibit 4-57. This exhibit shows total cost as the number of locations reporting plus the number of reports prepared, (the coefficients in the cost equation presented in Chapter 2 are set at $\underline{a} = 0$, $\underline{b} = 1$, and $\underline{c} = 1$). In this exhibit, a location must be below both criteria to qualify as a small manufacturer.

If the cost curves are put on the same graphs as the information curves, one can identify which small manufacturer definitions provide a given amount of information for the least cost, or alternatively, the most information for a given cost. As shown in Exhibit 4-58, in order to get the most locations for a given level of cost (or spend the least for a given number of locations), the definition should be set in the "northwest" corner of the graph. For a given cost constraint, say 15 percent reduction, we can approximate how many locations would be exempt under different definitions. The set of definitions, however, must fall on the cost isoquant labeled 15 percent. Following this cost isoquant, one sees that anywhere from approximately 17 percent to 8 percent of the locations could be exempted within this cost constraint. To maximize the number of locations reporting at a given cost constraint, one would move to the western (left) and northern (top) portion of that isoquant. Because the other isoquants are of the same general shape, to maximize the number of locations reporting for any given cost constraint, one would be driven toward the "northwest" portion of the cost isoquants, i.e., "high" sales parameter and "low" production quantity parameter.

Exhibit 4-59 displays isoquants of the percent of reports exempted along with isoquants of the cost proxy. These reports and cost isoquants are very similarly shaped because the cost function is driven primarily by the number of reports that must be prepared. However, upon close examination one sees that to get the most reports for a given level of cost, the definition should be set in the "southeast" portion of the curves, i.e., "low" sales parameter and "high" production quantity parameter.

Exhibit 4-60 displays isoquants of the percent of chemicals missed along with isoquants of the cost proxy. These curves clearly demonstrate that the most cost-effective small manufacturer definitions in terms of this proxy for information are in the "southeast" portion of the curves, i.e., "low" sales parameter and "high" production quantity parameter.

Exhibits 4-58 through 4-60 also display the effect that maximizing a proxy at a given level of cost has on the other proxies. For example, at a ten percent reduction in cost, 3.8 percent of locations will be exempted when the exemption is set at 4,540 kilograms (10,000 pounds) and $100 million (i.e., the "northwest" of Exhibit 4-58). At this exemption level, 11.7 percent of reports would be exempted and 9 percent of chemicals would be missed. However, more reports can be obtained at the cost of losing some locations by moving to the "southeast" of Exhibit 4-59. At 45.4 million kilograms (100 million pounds) and $5 million, the cost of reporting is still reduced ten percent, but 11.2 percent of locations and 9.6 percent of reports would be exempted, and 5.6 percent of chemicals would be missed.

Although the reporting costs in these two examples are the same, the information obtained varies. When locations are maximized, locations producing moderate quantities of chemicals (greater than 4,540 kilograms) must report in all sales ranges and the coverage of locations is representative across the sales ranges. When reports are maximized, however, three times as many locations are exempted, some of which produce chemicals in large quantities (up to 45.4 million kilograms). More reports are received from the lower production ranges of locations with moderate sales (greater than $5 million), reducing the total number of chemicals missed. There is almost no representation in the low sales ranges.

As mentioned above, nearly all production is covered for the full range of exemptions considered here for the case when locations must be below both parameters to be exempted. Therefore, isoquants are not presented here for the production proxy. However, for a given cost constraint, the percent of production not covered would be minimized in the "northwest" portion of the curves, i.e., "high" sales parameter and "low" production quantity parameter. The difference, however, in the relevant ranges considered here, are very small.

In Exhibits 4-58, 59 and 60, $\underline{a}$ is set equal to 0. We also investigated the case in which $\underline{a} = 1$, $\underline{b} = 1$, and $\underline{c} = 1$. The shapes of the cost isoquants are almost identical to the cases shown in Exhibits 4-58, 59, and 60, demonstrating that the rate of change of the total cost of reporting as a function of sales and production volume is not very sensitive to assumptions concerning the parent firm's role. This is expected because, as mentioned above, the total cost is primarily driven by the number of reports that are prepared.

The above analysis displays the cost-effective solutions for a particular set of coefficients, and for a given hypothetical reporting rule. However, not all reporting rules may be of the type discussed above. As discussed above in Chapter 3, EPA may develop various types of Section 8(a) rules. As shown by the difference between the cost estimates for the inventory reporting rule and for the preliminary assessment rule, there is no guarantee that the ratio between fixed and variable costs will be approximately 1:1 for different reporting rules.[1]

The conclusions for the hypothetical reporting rule analyzed above are unaltered by variations in the relative values of the coefficients. This can be illustrated first for the case in which a manufacturer must be under both criteria to be considered a small manufacturer. Exhibit 4-61 displays both report and location isoquants. As can be seen, moving to the left, the location isoquants curve upward more rapidly than the report isoquants. Therefore, a location isoquant which intersects a report isoquant will be above it at the left of the graph, and below it at the right. But the cost function is simply a linear combination of the report and location functions, and the cost isoquant will lie somewhere between the report and location isoquants (assuming $\underline{a} = 0$). The cost isoquant will therefore lie above the report isoquant at the left and below it on the right, keeping the lowest cost solutions in the "northwest" and "southeast" portions of the graphs for locations and reports respectively.

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[1] It does not matter if the absolute values of the fixed and variable costs change; only the relation between the two can influence this analysis.

The addition of firm-specific fixed costs leaves the conclusion unaltered if information is measured by reports prepared, but could affect the conclusions if information is measured by locations covered. This can be illustrated in Exhibit 4-62. One would move a short distance from point A, where a location, report, and firm isoquant (the latter not shown here) intersect, to point B, where the level of each isoquant is a small increment lower than its level at point A. One could then move directly upward, and eventually one report will move from exempt to non-exempt status. However, the change of one report may not necessarily move a location from exempt to non-exempt status: it depends on whether that is the only report made by that location. Similarly, as the upward movement continues, a location will eventually move from exempt to non-exempt status, but a firm will not necessarily move as well. Therefore, as one moves upward along line BC, one will first encounter the reports isoquant, then the location isoquant, and then the firm isoquant. By applying the analysis of changes in the relative values of b and c to the three coefficient case, one can easily show that the addition of firm-specific fixed costs also does not change the conclusion when information is represented by reports prepared.

However, when information is represented by the locations proxy, the existence of firm-specific costs means that changes in the relative values of the coefficients can change the conclusions. As c, the reports coefficient, increases relative to the other two coefficients, the cost isoquants are approximated by the reports isoquants, keeping the cost-effective solution for locations in the "northwest" corner of the graph. As a, the firm coefficient, increases relative to the other two coefficients, the cost isoquants are approximated by the firm isoquants, moving the cost-effective solution toward the "southeast" corner of the graph. Because the number of reports vastly outweighs the number of locations and the number of firms, the relative size of a to b and a to c would have to be quite large to cause this shift for the mix of chemicals and manufacturers examined here; at least in the range above 5:1. Therefore, this shift is considered unlikely.

The cost-effective solution for missed chemicals is also not sensitive to the relative values of the coefficients b and c in the cost equation. Even if b is much larger than c , or if c is much larger than b , the fewest chemicals are missed for a given cost constraint toward the "southeast" portion of the curves in Exhibit 4-60.

When the locations need only be below one parameter, the shapes of the curves change. For this type of exemption, the curves bend the other way and the proxies for which the cost-effective solutions were "southeast", become "northwest" (i.e., "low" production quantity and "high" sales), and vice-versa. Again, the relative value of b to c does not change the results.

We have demonstrated that the conclusions regarding cost-effective solutions are insensitive to alterations in the relative coefficient values for the hypothetical reporting rule analyzed here. However, the conclusions are not insensitive to changes in the type of reporting rule. For the purposes of the analyses conducted here, the differences between reporting rules are fully incorporated in one of two categories:

- differences in relative coefficient values; and
- differences in the mix of locations and chemicals covered by the reporting rule (the joint distribution of sales and production figures over the locations covered by the rule).

We have already shown that changes in relative coefficient values are unlikely to affect the conclusions. However, changes in the mix of firms and chemicals covered by the reporting rule can affect the conclusions. As shown in Appendix C, one can construct a different hypothetical reporting rule with a certain mix of locations and chemicals in which the cost-effective solution for reports is in the center of the graph rather than in the "southeast" corner for a rule in which a location must satisfy both criteria to qualify as a small manufacturer.[2]

It is also important to realize that the reporting rules actually promulgated may seldom, if ever, differ substantially from our primary example. Our conclusions are likely to hold for any rule in which the mix of locations and chemicals covered approximates the mix of locations and chemicals in our data. Only when the mix is markedly different than our example will the conclusions be altered.[3]

The above discussion is necessarily rather vague about the ways in which the mix of firms subject to the reporting rule might influence the shapes of the isoquants, which in turn might influence the conclusions. It is difficult to analyze the complex interactions represented by the joint distribution of sales and production and determine under what conditions our conclusions will hold. In order to fully investigate the degree to which our conclusions are generalizable to the types of rules which may actually be promulgated, it is necessary to perform these same data analyses on the chemicals and manufacturers covered by the individual rules. The exact structure and purposes of future Section 8(a) rules are as yet not fully identified; although, it is likely that future Section 8(a) rules will relate to a subset of those chemicals included in the data used for this analysis. Nevertheless, at a later date it may be useful to analyze individual rules to generate conclusions that may be more generalizable to all reporting rules.

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[2] It should also be noted that for a different reporting rule incorporating a different mix of chemicals and firms, the cost-effective solution when percent of chemicals missed is used as a proxy may no longer be resistant to changes in the relative values of $\underline{b}$ and $\underline{c}$.

[3] When a reporting rule covers only one chemical substance, the location, report, and cost isoquants will coincide, and as long as $\underline{a} = 0$ (or if each location is owned by a different firm), there will be no unique cost-effective solution for the reports, locations, or chemicals missed proxies.

4.3 MISSING AND CONFIDENTIAL DATA

The data used to generate the results of the analyses presented in this chapter exclude a significant portion of the information provided by EPA on the manufacturers of the 1459 chemicals chosen for this study. Some of the data provided by EPA were incomplete; thus preventing their inclusion. Other information was held confidential by the manufacturers; again preventing the inclusion of the data in this report. This section discusses whether the exclusion of these data is likely to bias the results and conclusions drawn here.

EPA identified 3778 manufacturing locations of the 1459 chemicals used in this study. The locations were identified from reports of production submitted by manufacturers to the Agency in 1977 when the TSCA Chemical Substance Inventory was compiled. From these reports, EPA determined in which of twelve possible production categories each chemical was produced at each location. These data may be in error either due to reporting errors or because production of these chemicals has changed since 1977.

Random reporting errors in so large a sample are not likely to cause a bias in the results presented here. However, if the accuracy of the information provided by certain segments of manufacturers, e.g., manufacturers that are small in terms of annual sales, was consistently below the accuracy of other segments of manufacturers, then some biases may develop. There has been no indication of such differentials in accuracy or of any systematic reporting bias in this sample. Therefore, the data are assumed to accurately reflect the production of this given list of chemicals in 1977 for the purposes of this report. (The initial reporting rule for the Inventory included a small manufacturer exemption that may affect the results of this analysis in the lower ranges of sales and production. This problem is discussed in Appendix A.)

If production of these chemicals has changed significantly since 1977, then the production data used here do not reflect the current status of the industry. For example, the development of a new, capital intensive production process may shift the majority of the production of a particular chemical from many small to a few large manufacturers. There is no way to tell from the data themselves whether production patterns have changed, or whether the general level of all production has increased or decreased. It is likely that the production of various chemicals fluctuated up and down, while the production of other chemicals increased or decreased steadily over the past four years. Therefore, in the absence of specific information on the changes in production of the 1459 chemicals used in this report, we assume that the 1977 production data provided by EPA are sufficiently accurate for the purposes of this study.

EPA also provided sales and employment information on 3778 manufacturers. This information was incomplete for 2386 locations. We completed the needed data for 1652 of these locations, leaving 734 locations incomplete. (Appendix A describes the process used to obtain the missing data.) Exhibit 4-63 displays the distribution of the reports of production across the twelve production categories for the 3044 locations used in the analysis and for the 3778 locations on which data were provided by EPA. The production statistics for the 3044 locations appear to be representative of the overall group of 3778 locations because:

- The distributions of reports across production categories are very similar; and
- The percentage of reports in each production category included in the analysis is not statistically different from the percentage of total locations included (80.6 percent). (This was determined by performing a chi-squared test on column (5) in Exhibit 4-63.)

It was not possible to determine whether the sales and employment statistics of the 3044 locations were representative of the overall group of 3778 locations because the lack of sales and/or employment data was the factor that excluded the 734 locations from the analysis. There is no obvious bias in the 2386 locations on which EPA did not provide complete information. In our search for data, we would not have found sales and employment data for any firms that were very small, because our data sources did not cover firms with very small assets. However, we were also unable to obtain the needed information for many locations that appeared to be part of larger corporations because they were identified by names such as "Plant #2." Therefore, the 3044 locations used in the analyses are very likely to be representative of the overall group of 3778 manufacturing locations of the 1459 chemicals.

Exhibit 4-63 also shows that approximately one-third of the reports of production are in catgories BLANK and N. Because the production quantities are unknown for these reports, it is not possible to test them against small manufacturer exemptions, and they were dropped from the analysis. A total of 658 locations submitted reports only in these two categories, reducing the total number of locations in the analysis to 2386.

Category N includes those chemicals on the list reported as not produced in 1977, but produced prior to 1977, and expected to be produced in the future. These chemicals are often produced in large batch processes on an infrequent basis. Information requested under future Section 8(a) rules is likely to be desired for these types of chemicals and production processes. However, a small manufacturer exemption with a production quantity parameter greater than zero will exempt many of these reports of production in any given year. In 1977, 6.5 percent of the chemicals analyzed in this report were only reported in production category N. Therefore, EPA may wish to vary the reporting period on a rule-by-rule basis in order to obtain this information. An alternative may be to require that reporting on chemicals produced infrequently in batch processes only be exempt on the basis of the sales (or employment) parameter of the exemptions.

Exhibit 4-64 shows that reports in production category N are slightly more concentrated in the smaller sales ranges than reports of production in categories 0 through 9. However, the distributions are generally similar, and the results of the analyses would vary insignificantly with the inclusion of these reports because the shapes of the isoquant curves would not change very much.

A larger percentage of total reports were held confidential by the manufacturing locations in 1977; category BLANK. A total of 8.8 percent of the chemicals examined in this report were only reported in category BLANK in 1977. EPA may exempt locations reporting confidentially held information on the same basis as other manufacturers, production quantity and sales (or employment). The results may not vary significantly because reports in category BLANK are distributed across the sales categories similarly to the reports of production in categories 0 through 9 (see Exhibit 4-64). The effect of the production parameter cannot be determined, however.

Chapter 5 analyzes options for setting the small manufacturer exemption.

EXHIBIT 4-1

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

	ANNUAL SALES (millions of dollars)										
PRODUCTION QUANTITY kilograms (pounds)	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.04	0.38	0.67	0.88	1.0	1.2	1.4	1.6	1.6	1.7
4,540 (10,000)	0.00	0.04	0.54	1.1	1.8	2.6	2.9	3.2	3.5	3.5	3.8
45,400 (100,000)	0.00	0.17	1.1	2.5	4.2	5.9	7.1	7.8	8.3	8.6	9.1
454,000 (1 million)	0.00	0.17	1.5	3.6	6.2	9.2	11.2	12.5	13.4	14.1	15.2
4.54 million (10 million)	0.00	0.17	1.6	4.0	6.9	10.6	13.4	15.2	16.5	17.6	19.4
22.7 million (50 million)	0.00	0.25	1.8	4.2	7.3	11.1	14.0	16.2	18.0	19.4	21.6
45.4 million (100 million)	0.00	0.25	1.8	4.2	7.3	11.2	14.3	16.6	18.5	19.9	22.5
227 million (500 million)	0.00	0.25	1.9	4.3	7.5	11.5	14.9	17.5	19.6	21.3	24.4
454 million (1 billion)	0.00	0.25	1.9	4.4	7.6	11.6	15.0	17.7	19.8	21.6	24.8

EXHIBIT 4-2

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

	ANNUAL SALES (millions of dollars)										
PRODUCTION QUANTITY kilograms (pounds)	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.25	1.9	4.4	7.6	11.6	15.1	17.7	19.9	21.8	25.1
454 (1,000)	2.8	3.0	4.3	6.4	9.5	13.4	16.7	19.0	21.2	22.9	26.2
4,540 (10,000)	6.7	7.0	8.1	10.0	12.5	15.8	18.9	21.2	23.2	25.0	26.6
45,400 (100,000)	16.0	16.1	16.9	17.9	19.5	21.8	24.0	26.0	27.7	29.2	32.1
454,000 (1 million)	31.5	31.6	31.9	32.3	32.9	34.0	35.4	36.7	38.1	39.2	41.5
4.54 million (10 million)	47.9	48.0	48.2	48.3	48.7	48.9	49.7	50.5	51.4	52.1	53.4
22.7 million (50 million)	64.0	64.0	64.1	64.2	68.3	64.5	65.0	65.5	66.0	66.4	67.5
45.4 million (100 million)	71.3	71.3	71.4	71.4	71.6	71.8	72.1	72.5	72.8	73.1	74.0
227 million (500 million)	89.9	89.9	90.0	90.0	90.1	90.1	90.2	90.2	90.3	90.4	90.7
454 million (1 billion)	95.1	95.1	95.1	95.1	95.1	95.1	95.2	95.2	95.2	95.3	95.5

EXHIBIT 4-3

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars)										
	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.05	0.39	1.9	2.2	3.0	4.6	5.1	6.4	6.7	7.5
4,540 (10,000)	0.00	0.06	0.70	2.4	3.4	5.0	7.4	8.2	9.6	10.4	11.7
45,400 (100,000)	0.00	0.10	0.94	3.2	4.9	7.4	10.7	12.0	13.9	15.1	17.1
454,000 (1 million)	0.00	0.10	1.1	3.6	5.6	8.9	12.7	14.5	16.8	18.3	20.8
4.54 million (10 million)	0.00	0.10	1.2	3.8	5.9	9.4	13.5	15.5	18.1	19.8	22.9
22.7 million (50 million)	0.00	0.12	1.2	3.9	6.0	9.6	13.8	16.0	18.8	20.6	24.0
45.4 million (100 million)	0.00	0.12	1.2	3.9	6.1	9.6	14.0	16.3	19.1	20.9	24.5
227 million (500 million)	0.00	0.12	1.3	4.0	6.2	9.8	14.2	16.6	19.5	21.5	25.5
454 million (1 billion)	0.00	0.12	1.4	4.0	6.2	9.9	14.3	16.7	19.6	21.6	25.7

EXHIBIT 4-4

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars)										
	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.12	1.4	4.0	6.2	9.9	14.3	16.7	19.7	21.7	25.9
454 (1,000)	12.7	12.8	13.7	14.9	16.7	19.6	22.4	24.4	26.1	27.7	31.2
4,540 (10,000)	20.2	20.3	20.9	21.8	23.1	25.1	27.1	28.8	30.3	31.5	34.5
45,400 (100,000)	31.1	31.1	31.5	31.9	32.4	33.5	34.7	35.8	36.9	37.6	39.9
454,000 (1 million)	44.7	44.7	44.9	45.1	45.3	45.7	46.3	46.9	47.6	48.0	49.8
4.54 million (10 million)	60.0	60.0	60.2	60.2	60.4	60.5	60.8	61.3	61.6	61.9	63.0
22.7 million (50 million)	74.3	74.3	74.4	74.5	74.5	74.6	74.8	75.0	75.2	75.4	76.3
45.4 million (100 million)	81.5	81.5	81.6	81.6	81.7	81.8	81.8	82.0	82.1	82.2	82.9
227 million (500 million)	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.6	95.6	95.6	95.9
454 million (1 billion)	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.1	98.1	98.2

EXHIBIT 4-5

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars)										
	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,540 (10,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45,400 (100,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454,000 (1 million)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02
4.54 million (10 million)	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.06	0.07	0.08	0.11
22.7 million (50 million)	0.00	0.00	0.03	0.04	0.07	0.09	0.15	0.22	0.29	0.31	0.43
45.4 million (100 million)	0.00	0.00	0.06	0.07	0.08	0.15	0.27	0.43	0.57	0.65	0.94
227 million (500 million)	0.00	0.00	0.25	0.26	0.43	0.64	1.0	1.5	1.8	2.2	3.8
454 million (1 billion)	0.00	0.00	0.50	0.68	0.95	1.2	1.6	2.3	2.7	3.2	5.7

EXHIBIT 4-6

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars)										
	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.50	0.70	0.90	1.2	1.8	2.5	3.3	4.2	8.3
454 (1,000)	0.00	0.00	0.50	0.70	0.90	1.2	1.8	2.5	3.3	4.2	8.3
4,540 (10,000)	0.00	0.00	0.50	0.70	0.90	1.2	1.8	2.5	3.3	4.2	8.3
45,400 (100,000)	0.00	0.00	0.50	0.70	1.0	1.2	1.8	2.5	3.3	4.2	8.3
454,000 (1 million)	0.10	0.10	0.60	0.80	1.0	1.3	1.9	2.6	3.4	4.2	8.3
4.54 million (10 million)	0.80	0.80	1.3	1.4	1.7	2.0	2.6	3.2	4.0	4.8	8.9
22.7 million (50 million)	5.0	5.0	5.5	5.7	5.9	6.2	6.7	7.3	8.0	8.9	12.9
45.4 million (100 million)	11.4	11.4	11.8	12.0	12.2	12.5	12.9	13.5	14.1	14.9	18.7
227 million (500 million)	52.8	52.8	53.0	53.2	53.3	53.4	53.6	53.8	54.2	54.7	57.2
454 million (1 billion)	75.4	75.4	75.4	75.4	75.4	75.4	75.6	75.6	76.0	76.4	77.9

EXHIBIT 4-7

PERCENT OF TOTAL CHEMICALS MISSED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars)										
	0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.38	1.66	1.95	2.53	3.83	4.08	5.16	5.45	6.30
4,540 (10,000)	0.00	0.00	0.46	1.87	2.63	3.70	5.48	5.95	7.20	7.90	9.05
45,400 (100,000)	0.00	0.02	0.53	2.22	3.26	4.92	7.14	7.95	9.50	10.52	12.74
454,000 (1 million)	0.00	0.02	0.55	2.30	3.43	5.40	7.75	8.76	10.52	11.72	14.40
4.54 million (10 million)	0.00	0.02	0.55	2.34	3.49	5.57	8.06	9.13	10.98	12.26	15.05
22.7 million (50 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.21	11.07	12.36	15.16
45.4 million (100 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23	11.09	12.37	15.23
227 million (500 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23	11.09	12.37	15.23
454 million (1 billion)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23	11.09	12.37	15.23

EXHIBIT 4-8

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: SALES AND PRODUCTION QUANTITY PARAMETERS[a]

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars) 0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.05	0.39	1.65	1.98	2.61	3.98	4.42	5.47	5.73	6.42
4,540 (10,000)	0.00	0.06	0.66	2.20	3.12	4.55	6.57	7.23	8.45	9.09	10.18
45,400 (100,000)	0.00	0.11	0.96	3.08	4.76	7.15	10.01	11.24	12.84	13.90	15.58
454,000 (1 million)	0.00	0.11	1.16	3.64	5.75	8.92	12.39	14.11	16.15	17.49	19.78
4.54 million (10 million)	0.00	0.11	1.25	3.84	6.07	9.62	13.45	15.42	17.79	19.38	22.24
22.7 million (50 million)	0.00	0.14	1.34	3.96	6.28	9.88	13.87	16.07	18.65	20.34	23.52
45.4 million (100 million)	0.00	0.14	1.37	3.98	6.31	9.95	14.04	16.33	19.00	20.76	24.15
227 million (500 million)	0.00	0.14	1.43	4.05	6.43	10.13	14.34	16.79	19.56	21.44	25.29
454 million (1 billion)	0.00	0.14	1.46	4.10	6.50	10.22	14.42	16.90	19.70	21.59	25.56

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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-9

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: SALES AND PRODUCTION QUANTITY PARAMETERS[a]

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	ANNUAL SALES (millions of dollars) 0.0	0.1	0.5	1.0	2.5	5.0	10	20	30	50	100
0 (0)	0.00	0.14	1.46	4.10	6.50	10.2	14.4	16.9	19.8	21.7	25.8
454 (1,000)	10.8	11.0	11.9	13.3	15.4	18.5	21.3	23.4	25.1	26.8	30.2
4,540 (10,000)	17.7	17.9	18.5	19.6	21.1	23.4	25.6	27.4	29.0	30.3	33.3
45,400 (100,000)	28.2	28.3	28.7	29.3	30.0	31.3	32.7	33.9	35.2	36.0	38.4
454,000 (1 million)	42.2	42.2	42.5	42.6	42.9	43.5	44.2	45.0	45.8	46.4	48.2
4.54 million (10 million)	57.7	57.8	57.9	58.0	58.2	58.3	58.7	59.2	59.7	60.0	61.3
22.7 million (50 million)	72.4	72.4	72.5	72.5	72.6	72.7	73.0	73.2	73.5	73.7	74.6
45.4 million (100 million)	79.6	79.6	79.7	79.7	79.8	79.9	80.0	80.2	80.3	80.5	81.2
227 million (500 million)	94.4	94.4	94.4	94.5	94.5	94.5	94.5	94.6	94.6	94.6	94.9
454 million (1 billion)	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.6	97.7

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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-10

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT
FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS
(Location must be below both parameters to be exempted)

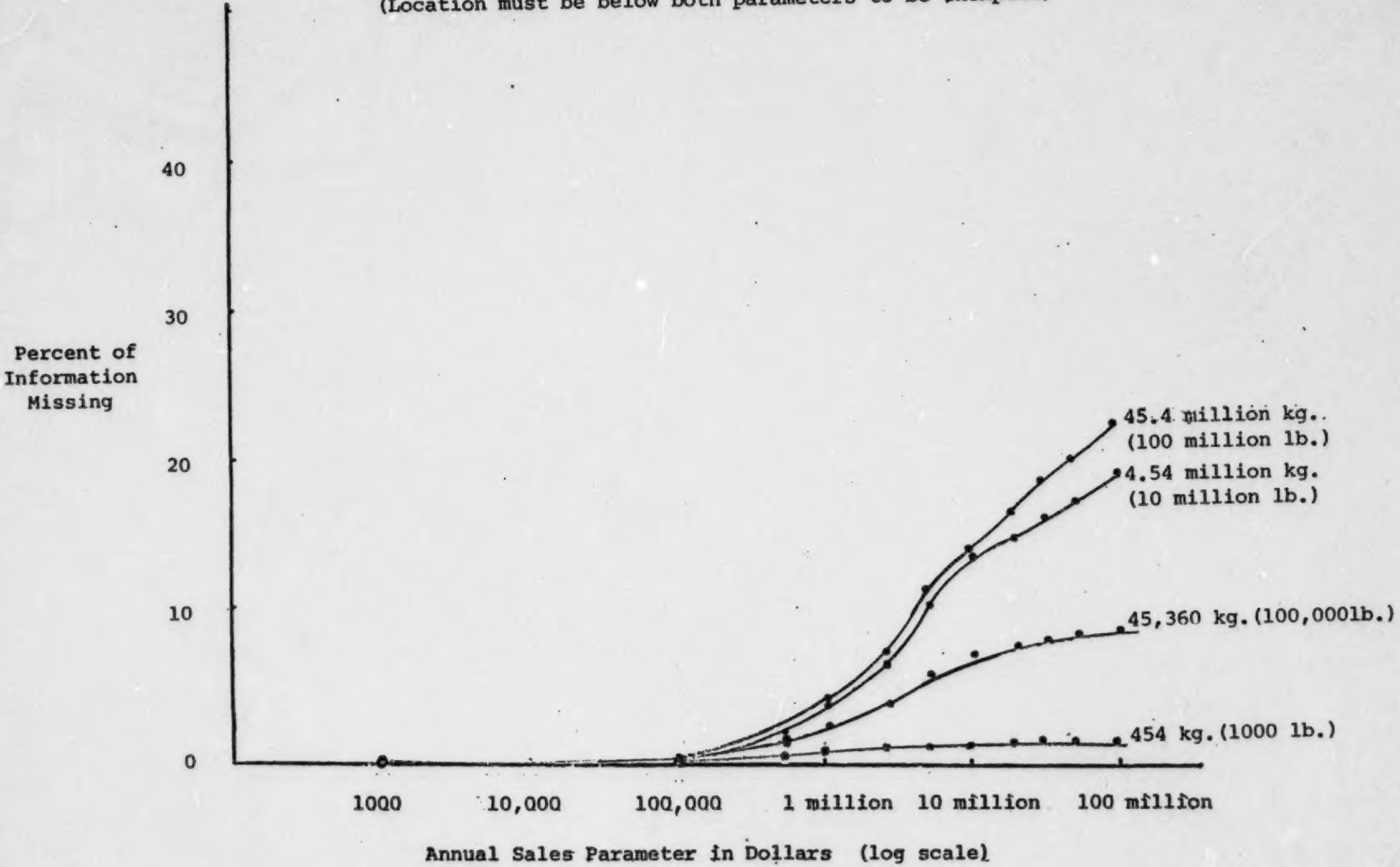


EXHIBIT 4-11

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT
FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS
(Location need only be below one parameter to be exempted)

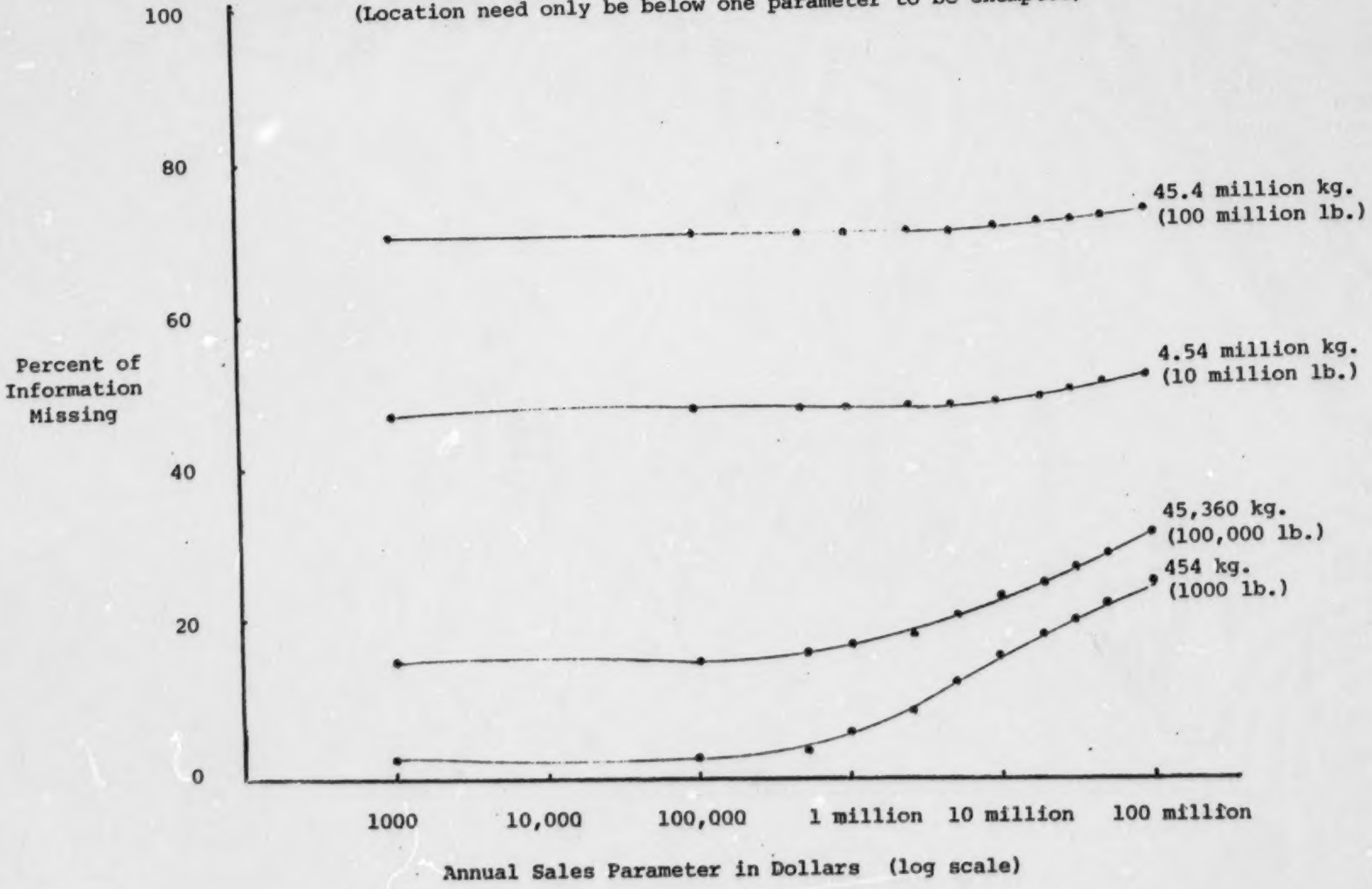


EXHIBIT 4-12

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED
FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS
(Location must be below both parameters to be exempted)

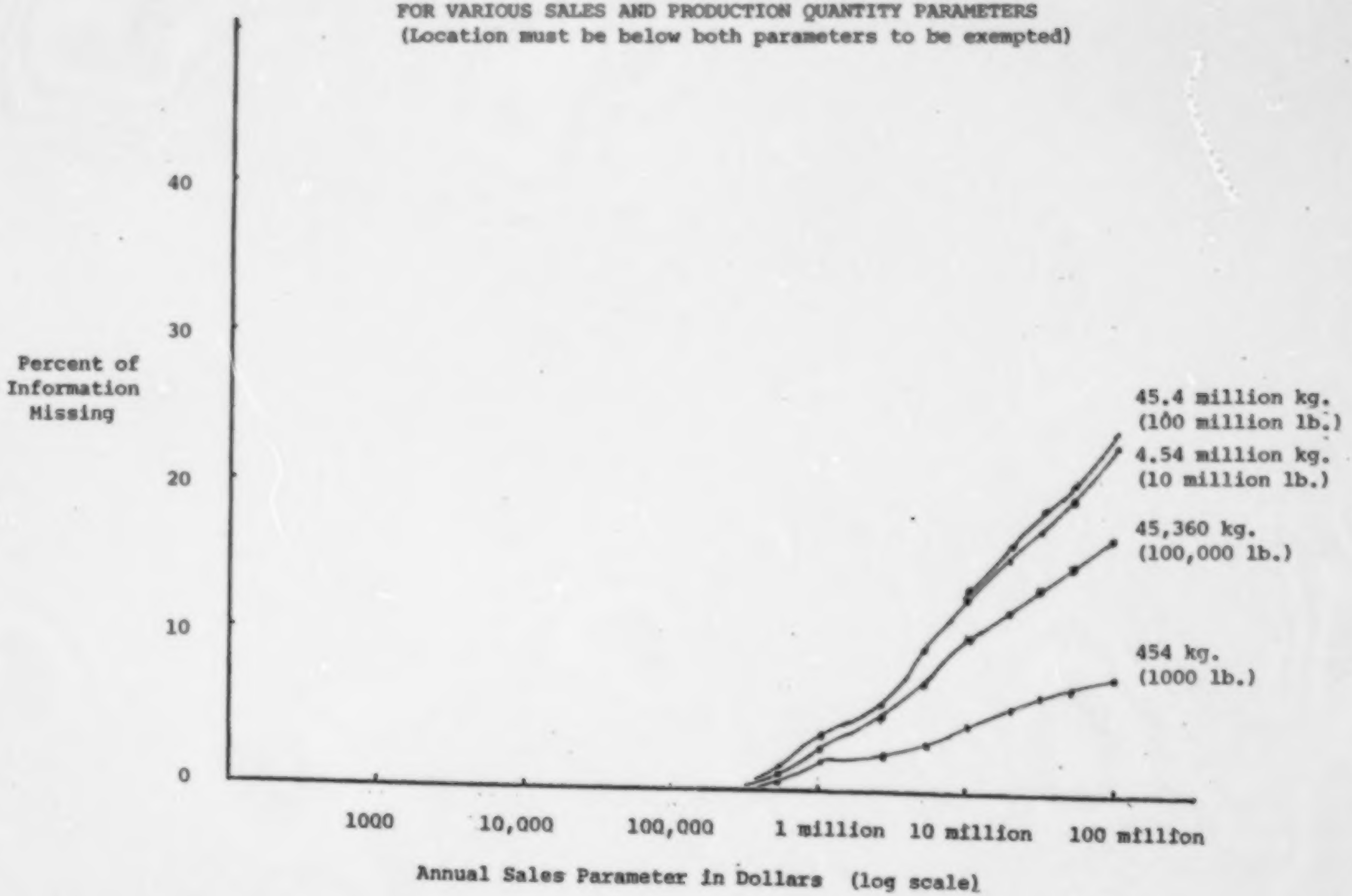


EXHIBIT 4-13

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS
(Location must be below only one parameter to be exempted)

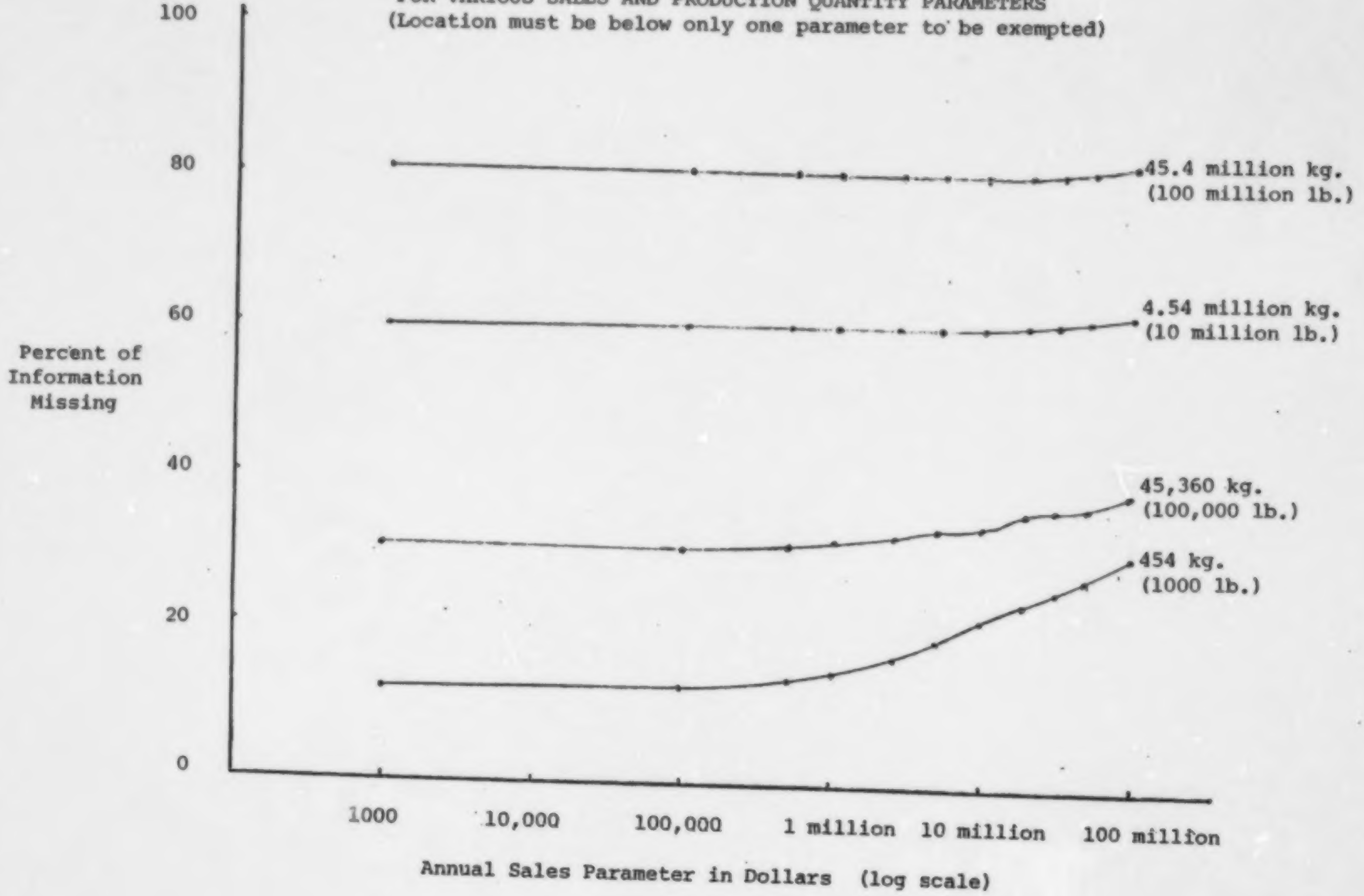


EXHIBIT 4-14
PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

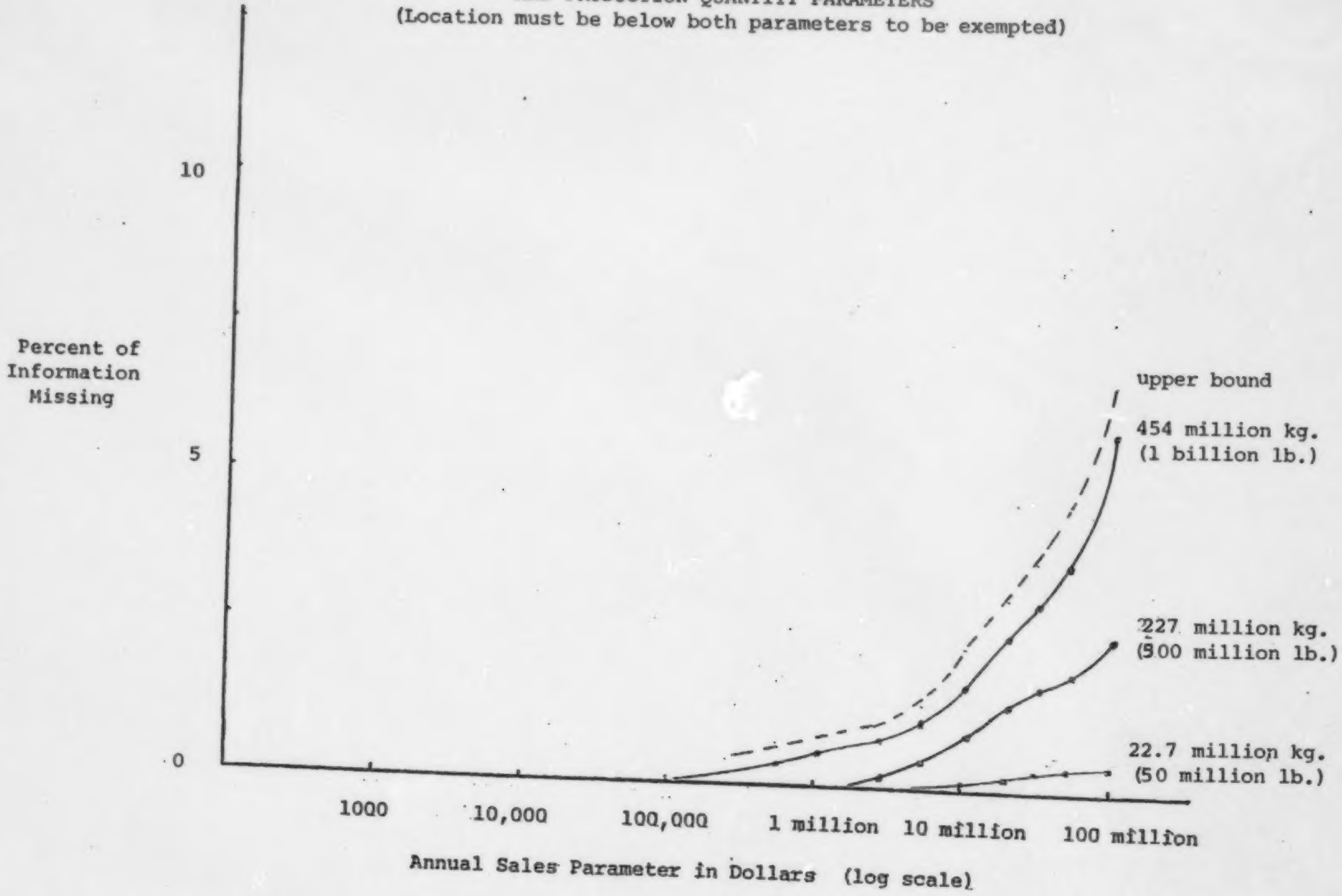


EXHIBIT 4-15

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS
(Location need only be below one parameter to be exempted.)

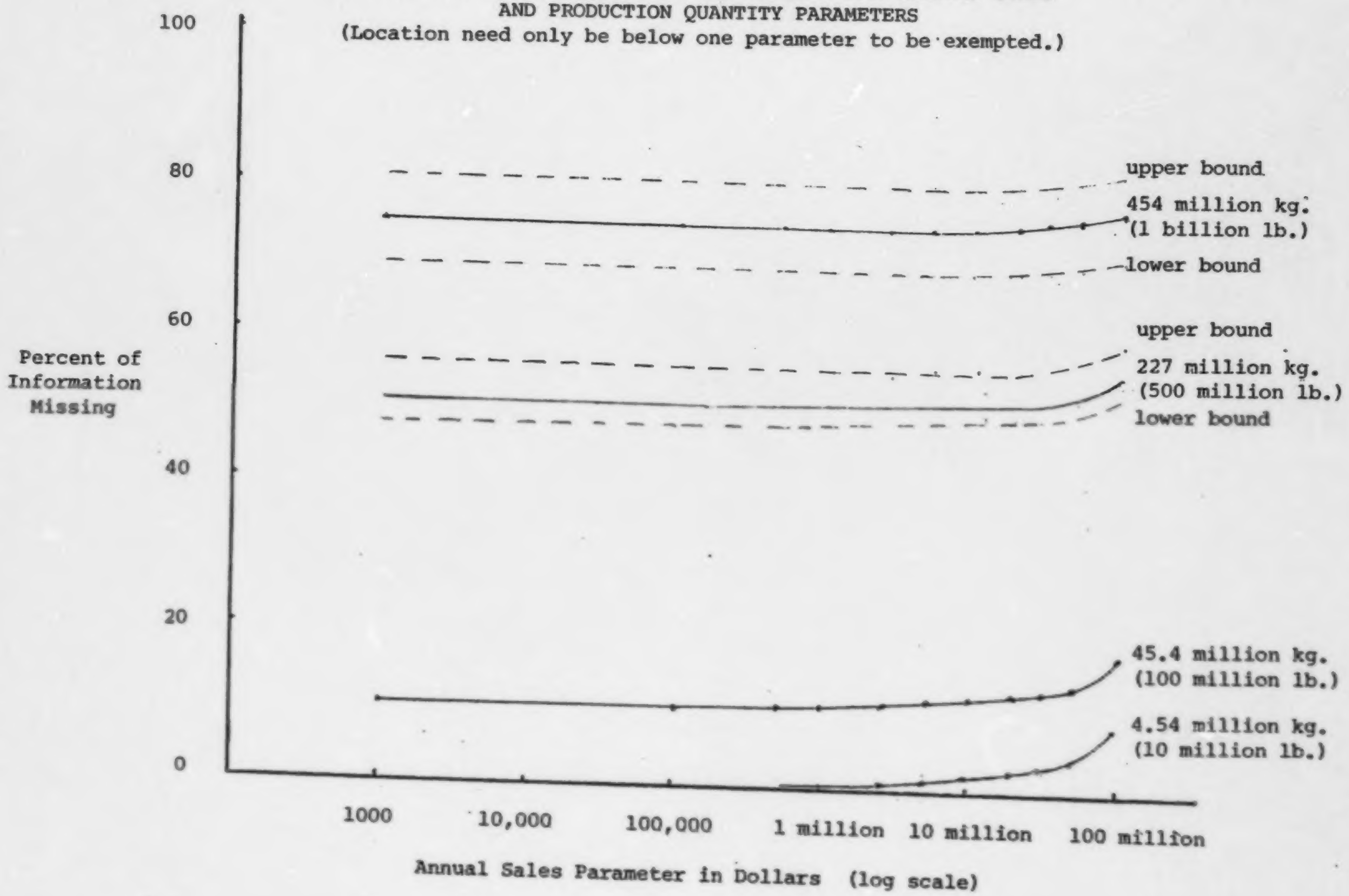


EXHIBIT 4-16

PERCENT OF TOTAL CHEMICALS MISSED FOR VARIOUS SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

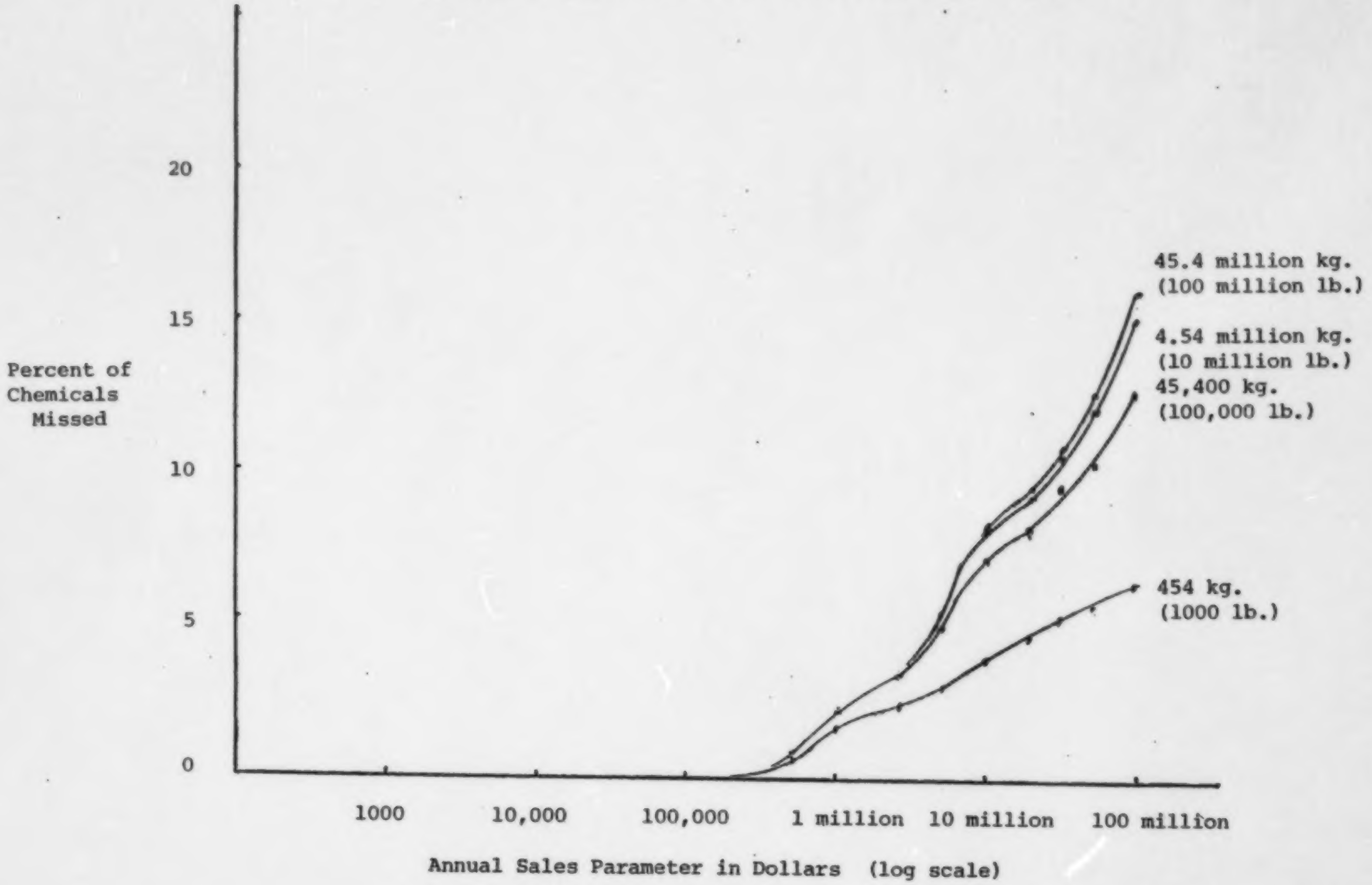
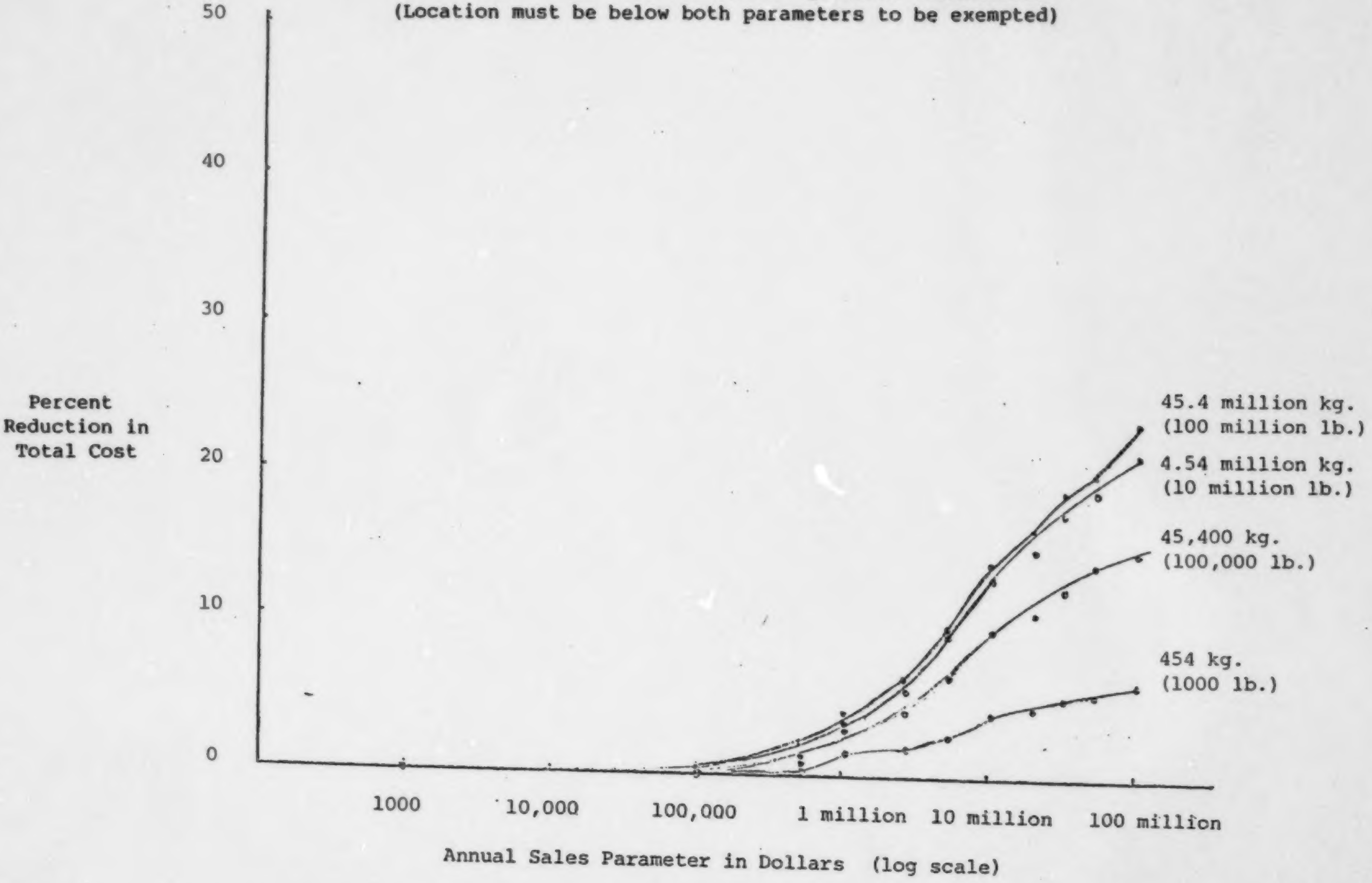


EXHIBIT 4-17

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: SALES AND PRODUCTION QUANTITY PARAMETERS[a]

(Location must be below both parameters to be exempted)



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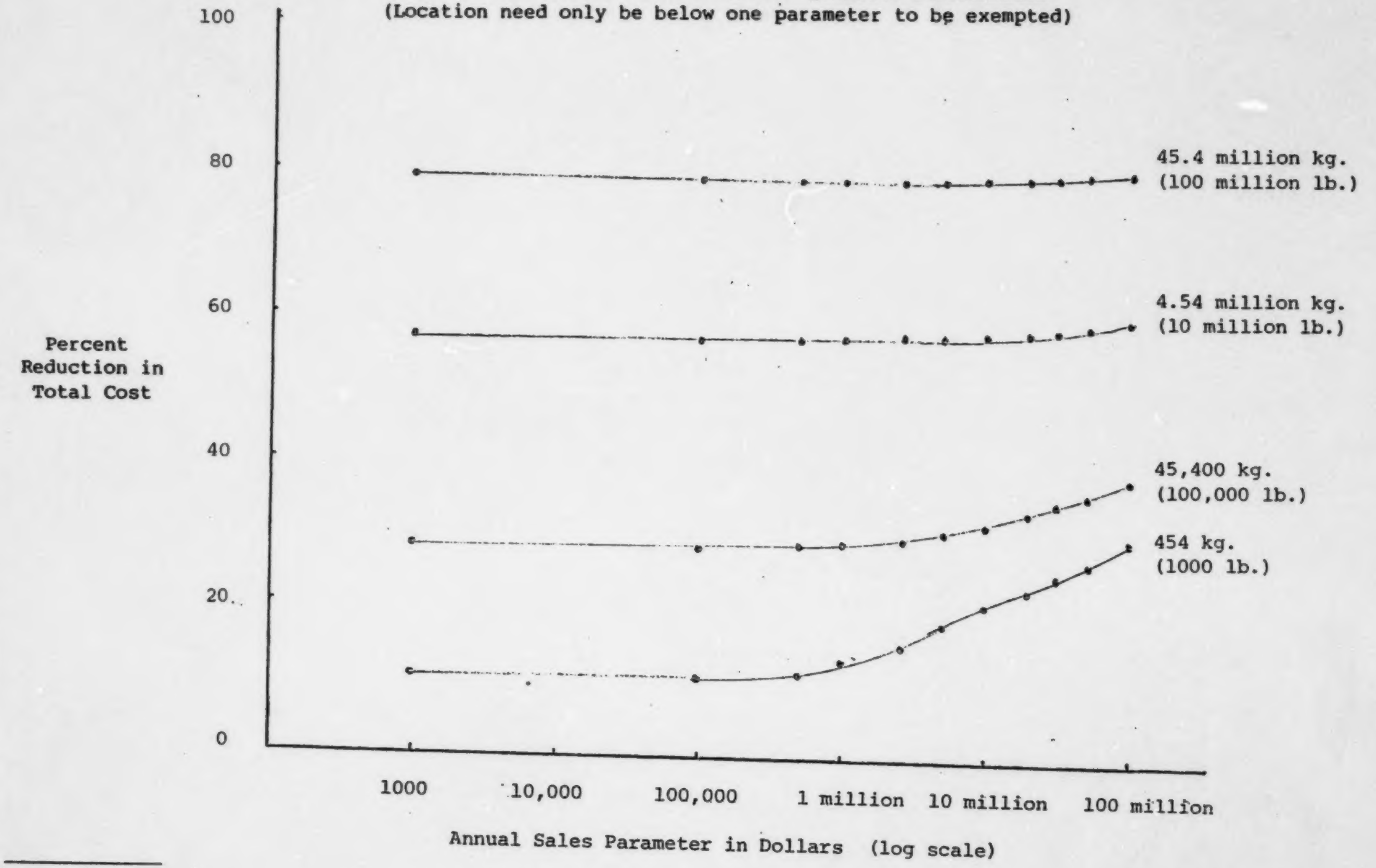
[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-18

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: SALES AND PRODUCTION QUANTITY PARAMETERS[a]
(Location need only be below one parameter to be exempted)



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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-19

CHANGE IN THE PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.40	0.85	0.58	0.14	0.05	0.04	0.02	0.02	0.00	0.00
4,540 (10,000)	0.4	1.2	1.1	0.47	0.32	0.06	0.03	0.03	0.00	0.01
45,400 (100,000)	1.7	2.3	2.8	1.1	0.68	0.24	0.07	0.05	0.02	0.01
454,000 (1 million)	1.7	3.3	4.2	1.7	1.2	0.40	0.13	0.09	0.04	0.02
4.54 million (10 million)	1.7	3.6	4.8	1.9	1.5	0.56	0.18	0.13	0.06	0.04
22.7 million (50 million)	2.5	3.9	4.8	2.1	1.5	0.58	0.22	0.18	0.07	0.04
45.4 million (100 million)	2.5	3.9	4.8	2.1	1.6	0.62	0.23	0.19	0.07	0.05
227 million (500 million)	2.5	4.1	4.8	2.1	1.6	0.68	0.26	0.21	0.09	0.06
454 million (1 billion)	2.5	4.1	5.0	2.1	1.6	0.68	0.27	0.21	0.09	0.06

EXHIBIT 4-20

CHANGE IN THE PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	2.5	4.1	5.0	2.1	1.6	0.70	0.26	0.22	0.10	0.07
454 (1,000)	2.0	3.2	4.2	2.1	1.6	0.66	0.23	0.22	0.09	0.07
4,540 (10,000)	3.0	2.7	3.8	1.7	1.3	0.62	0.26	0.17	0.09	0.03
45,400 (100,000)	1.0	2.0	2.0	1.1	0.92	0.44	0.20	0.17	0.08	0.06
454,000 (1 million)	1.0	0.75	0.80	0.40	0.44	0.28	0.13	0.14	0.06	0.05
4.54 million (10 million)	1.0	0.50	0.20	0.27	0.08	0.16	0.08	0.09	0.04	0.03
22.7 million (50 million)	0.00	0.25	0.2	0.07	0.08	0.10	0.05	0.05	0.02	0.02
45.4 million (100 million)	0.00	0.25	0.00	0.13	0.08	0.06	0.04	0.03	0.02	0.02
227 million (500 million)	0.00	0.25	0.00	0.07	0.00	0.02	0.00	0.01	0.01	0.01
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00

EXHIBIT 4-21

CHANGE IN THE PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.50	0.85	3.0	0.20	0.32	0.32	0.05	0.13	0.02	0.02
4,540 (10,000)	0.60	1.6	3.4	0.67	0.64	0.48	0.08	0.14	0.04	0.03
45,400 (100,000)	1.0	2.1	4.5	1.1	1.0	0.66	0.13	0.19	0.06	0.04
454,000 (1 million)	1.0	2.5	5.0	1.3	1.3	0.76	0.18	0.23	0.08	0.05
4.54 million (10 million)	1.0	2.7	5.2	1.4	1.4	0.82	0.20	0.26	0.09	0.06
22.7 million (50 million)	1.2	2.7	5.4	1.4	1.4	0.84	0.22	0.28	0.09	0.07
45.4 million (100 million)	1.2	2.7	5.4	1.5	1.4	0.88	0.23	0.28	0.09	0.07
227 million (500 million)	1.2	3.0	5.4	1.5	1.4	0.88	0.24	0.29	0.10	0.08
454 million (1 billion)	1.2	3.2	5.2	1.5	1.5	0.88	0.24	0.29	0.10	0.08

EXHIBIT 4-22

CHANGE IN THE PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER
(Location need only be below one parameter to be exempted)

SHIFT OF ANNUAL SALES PARAMETER
(millions of dollars)

PRODUCTION QUANTITY kilograms (pounds)	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	1.2	3.2	5.2	1.5	1.5	0.88	0.24	0.30	0.10	0.08
454 (1,000)	1.0	2.2	2.4	1.2	1.2	0.56	0.20	0.17	0.08	0.07
4,540 (10,000)	1.0	1.5	1.8	0.87	0.80	0.40	0.17	0.15	0.06	0.06
45,400 (100,000)	0.00	1.0	0.80	0.33	0.44	0.24	0.11	0.11	0.04	0.05
454,000 (1 million)	0.00	0.50	0.40	0.13	0.16	0.12	0.06	0.07	0.02	0.04
4.54 million (10 million)	0.00	0.50	0.00	0.13	0.04	0.06	0.05	0.03	0.02	0.02
22.7 million (50 million)	0.00	0.25	0.20	0.00	0.04	0.04	0.02	0.02	0.01	0.02
45.4 million (100 million)	0.00	0.25	0.00	0.07	0.04	0.00	0.02	0.01	0.01	0.04
227 million (500 million)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00

EXHIBIT 4-23

CHANGE IN PERCENT OF TOTAL PRODUCTION NOT COVERED PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,540 (10,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45,400 (100,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454,000 (1 million)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.54 million (10 million)	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
22.7 million (50 million)	0.00	0.07	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00
45.4 million (100 million)	0.00	0.15	0.02	0.01	0.03	0.02	0.02	0.01	0.00	0.01
227 million (500 million)	0.00	0.62	0.02	0.11	0.08	0.07	0.05	0.01	0.04	0.03
454 million (1 billion)	0.00	1.2	0.36	0.18	0.10	0.08	0.07	0.04	0.02	0.05

EXHIBIT 4-24

CHANGE IN PERCENT OF TOTAL PRODUCTION NOT COVERED PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	1.2	0.40	0.13	0.12	0.12	0.07	0.08	0.05	0.08
454 (1,000)	0.00	1.2	0.40	0.13	0.12	0.12	0.07	0.08	0.05	0.08
4,540 (10,000)	0.00	1.2	0.40	0.13	0.12	0.12	0.07	0.08	0.05	0.08
45,400 (100,000)	0.00	1.2	0.40	0.20	0.08	0.12	0.07	0.08	0.05	0.08
454,000 (1 million)	0.00	1.2	0.40	0.13	0.12	0.12	0.07	0.08	0.04	0.08
4.54 million (10 million)	0.00	1.2	0.20	0.20	0.12	0.12	0.06	0.08	0.04	0.08
22.7 million (50 million)	0.00	1.2	0.40	0.13	0.12	0.10	0.06	0.07	0.05	0.08
45.4 million (100 million)	0.00	1.0	0.40	0.13	0.12	0.08	0.06	0.06	0.04	0.08
227 million (500 million)	0.00	0.50	0.40	0.07	0.04	0.04	0.02	0.04	0.03	0.05
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.02	0.01

EXHIBIT 4-25

CHANGE IN THE PERCENT OF TOTAL CHEMICALS MISSED PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.95	2.6	0.19	0.23	0.26	0.02	0.11	0.01	0.02
4,540 (10,000)	0.00	1.1	2.8	0.51	0.43	0.36	0.05	0.12	0.04	0.02
45,400 (100,000)	0.20	1.3	3.4	0.69	0.66	0.44	0.08	0.15	0.05	0.04
454,000 (1 million)	0.20	1.3	3.5	0.75	0.79	0.47	0.10	0.18	0.06	0.05
4.54 million (10 million)	0.20	1.3	3.6	0.77	0.83	0.50	0.11	0.19	0.06	0.06
22.7 million (50 million)	0.20	1.3	3.6	0.78	0.84	0.50	0.11	0.19	0.06	0.06
45.4 million (100 million)	0.20	1.3	3.6	0.78	0.84	0.50	0.11	0.19	0.06	0.06
227 million (500 million)	0.20	1.3	3.6	0.78	0.84	0.50	0.11	0.19	0.06	0.06
454 million (1 billion)	0.20	1.3	3.6	0.78	0.84	0.52	0.11	0.19	0.06	0.06

EXHIBIT 4-26

CHANGE IN PERCENT REDUCTION IN TOTAL COST TO INDUSTRY PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.50	0.85	2.5	0.22	0.25	0.27	0.04	0.10	0.01	0.01
4,540 (10,000)	0.60	1.5	3.1	0.61	0.57	0.44	0.06	0.12	0.03	0.02
45,400 (100,000)	1.1	2.1	4.2	1.1	0.96	0.57	0.12	0.16	0.05	0.03
454,000 (1 million)	1.1	2.6	5.0	1.4	1.3	0.70	0.17	0.20	0.07	0.05
4.54 million (10 million)	1.1	2.8	5.2	1.5	1.4	0.77	0.20	0.24	0.08	0.06
22.7 million (50 million)	1.4	3.0	5.2	1.5	1.4	0.80	0.22	0.26	0.08	0.06
45.4 million (100 million)	1.4	3.0	5.2	1.5	1.5	0.81	0.23	0.27	0.09	0.07
227 million (500 million)	1.4	3.2	5.2	1.6	1.5	0.84	0.24	0.28	0.09	0.08
454 million (1 billion)	1.4	3.3	5.3	1.6	1.5	0.84	0.25	0.28	0.09	0.08

EXHIBIT 4-27

CHANGE IN PERCENT REDUCTION IN TOTAL COST TO INDUSTRY PER A ONE MILLION DOLLAR INCREASE IN THE SALES PARAMETER

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF ANNUAL SALES PARAMETER (millions of dollars)									
	0 to .1	0.1 to 0.5	0.5 to 1.0	1.0 to 2.5	2.5 to 5.0	5.0 to 10	10 to 20	20 to 30	30 to 50	50 to 100
0 (0)	1.4	3.3	5.3	1.6	1.5	0.84	0.25	0.29	0.10	0.08
454 (1,000)	2.0	2.25	2.8	1.4	1.2	0.56	0.21	0.17	0.08	0.07
4,540 (10,000)	2.0	1.5	2.2	1.0	0.92	0.44	0.18	0.16	0.07	0.06
45,400 (100,000)	1.0	1.0	1.2	0.47	0.52	0.28	0.12	0.13	0.04	0.05
454,000 (1 million)	0.00	0.75	0.20	0.20	0.24	0.14	0.08	0.08	0.03	0.04
4.54 million (10 million)	1.0	0.25	0.20	0.13	0.04	0.08	0.05	0.05	0.02	0.03
22.7 million (50 million)	0.00	0.25	0.00	0.07	0.04	0.06	0.02	0.03	0.01	0.02
45.4 million (100 million)	0.00	0.25	0.00	0.07	0.04	0.02	0.02	0.01	0.01	0.01
227 million (500 million)	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.01
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXHIBIT 4-28

LOWER BOUND ON THE PERCENT OF CHEMICALS THAT WOULD BE MISSED AS A FUNCTION OF THE PRODUCTION QUANTITY PARAMETER WHEN LOCATIONS NEED ONLY BE BELOW ONE PARAMETER TO BE EXEMPTED

Production Quantity kg. (lbs.)	Percent of Chemicals That Would Be Missed (%)
0 (0)	0.0
454 (1,000)	12.5
4,540 (10,000)	18.8
45,400 (100,000)	31.6
454,000 (1 million)	49.3
4.54 million (10 million)	67.9
22.7 million (50 million)	80.0
45.4 million (100 million)	84.5
227 million (500 million)	92.8
454 million (1 billion)	95.4

EXHIBIT 4-29

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.08	0.17	0.54	0.83	1.0	1.2	1.3
4,540 (10,000)	0.00	0.08	0.25	0.92	1.4	2.5	3.0	3.2
45,400 (100,000)	0.00	0.13	0.50	1.9	3.4	6.2	7.2	7.8
454,000 (1 million)	0.00	0.34	1.0	3.0	5.4	9.4	11.3	12.5
4.54 million (10 million)	0.00	0.38	1.3	3.6	6.4	11.2	13.8	15.5
22.7 million (50 million)	0.00	0.46	1.4	3.9	6.9	11.9	14.8	17.0
45.4 million (100 million)	0.00	0.46	1.4	3.9	6.9	12.2	15.1	17.5
227 million (500 million)	0.00	0.46	1.4	3.9	6.9	12.3	15.6	18.7
454 million (1 billion)	0.00	0.46	1.4	3.9	6.9	12.4	15.8	18.9

EXHIBIT 4-30

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

	TOTAL EMPLOYMENT							
PRODUCTION QUANTITY kilograms (pounds)	1	4	6	11	21	51	101	201
0 (0)	0.00	0.46	1.4	3.9	7.0	12.4	15.8	19.0
454 (1,000)	2.8	3.1	4.0	6.1	8.9	14.1	17.4	20.5
4,540 (10,000)	6.7	7.1	7.9	9.7	12.3	16.6	19.6	22.5
45,400 (100,000)	16.1	16.4	16.9	18.0	19.6	22.3	24.7	27.3
454,000 (1 million)	31.5	31.6	31.9	32.4	33.1	34.5	36.0	38.0
4.54 million (10 million)	47.9	48.0	48.0	48.2	48.5	49.2	50.0	51.4
22.7 million (50 million)	64.0	64.0	64.0	64.0	64.1	64.5	65.0	66.0
45.4 million (100 million)	71.3	71.3	71.3	71.4	71.4	71.6	72.0	72.8
227 million (500 million)	89.9	89.9	89.9	90.0	90.0	90.1	90.1	90.3
454 million (1 billion)	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.2

EXHIBIT 4-31

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

	TOTAL EMPLOYMENT							
PRODUCTION QUANTITY kilograms (pounds)	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.07	0.35	1.2	2.3	4.0	5.7	6.4
4,540 (10,000)	0.00	0.08	0.54	1.6	3.2	6.4	8.7	9.8
45,400 (100,000)	0.00	0.18	0.77	2.2	4.7	9.4	12.2	13.9
454,000 (1 million)	0.00	0.23	1.0	2.7	5.6	10.9	14.4	16.7
4.54 million (10 million)	0.00	0.26	1.1	3.0	5.9	11.7	15.4	18.0
22.7 million (50 million)	0.00	0.28	1.1	3.0	6.1	11.9	15.8	18.7
45.4 million (100 million)	0.00	0.28	1.1	3.0	6.1	12.0	16.0	19.1
227 million (500 million)	0.00	0.28	1.1	3.1	6.1	12.1	16.2	19.5
454 million (1 billion)	0.00	0.28	1.1	3.1	6.2	12.2	16.2	19.6

EXHIBIT 4-32

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.28	1.6	3.1	6.2	12.2	16.2	19.7
454 (1,000)	12.7	13.0	13.5	14.7	16.6	20.9	23.3	26.0
4,540 (10,000)	20.2	20.4	20.8	21.8	23.2	26.0	27.8	30.1
45,400 (100,000)	31.1	31.2	31.5	32.0	32.5	33.9	35.1	36.9
454,000 (1 million)	44.7	44.7	44.8	45.1	45.3	45.9	46.5	47.6
4.54 million (10 million)	60.0	60.0	60.0	60.2	60.3	60.5	60.8	61.6
22.7 million (50 million)	74.3	74.3	74.3	74.4	74.4	74.6	74.8	75.3
45.4 million (100 million)	81.5	81.5	81.5	81.6	81.6	81.7	81.8	82.1
227 million (500 million)	95.5	95.5	95.5	95.5	95.5	95.6	95.5	95.6
454 million (1 billion)	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.1

EXHIBIT 4-33

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Locations must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,540 (10,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45,400 (100,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454,000 (1 million)	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02
4.54 million (10 million)	0.00	0.00	0.00	0.01	0.02	0.04	0.06	0.07
22.7 million (50 million)	0.00	0.00	0.00	0.01	0.06	0.12	0.20	0.27
45.4 million (100 million)	0.00	0.00	0.00	0.04	0.07	0.19	0.30	0.60
227 million (500 million)	0.00	0.00	0.00	0.21	0.24	0.50	0.93	1.9
454 million (1 billion)	0.00	0.00	0.00	0.47	0.59	1.0	1.4	2.8

EXHIBIT 4-34

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.50	0.60	1.0	1.7	3.3
454 (1,000)	0.00	0.00	0.00	0.50	0.60	1.0	1.7	3.3
4,540 (10,000)	0.00	0.00	0.00	0.50	0.60	1.0	1.7	3.3
45,400 (100,000)	0.00	0.00	0.00	0.50	0.60	1.0	1.7	3.3
454,000 (1 million)	0.10	0.10	0.10	0.50	0.70	1.1	1.7	3.3
4.54 million (10 million)	0.80	0.80	0.80	1.2	1.3	1.7	2.4	4.0
22.7 million (50 million)	5.0	5.0	5.0	5.5	5.5	5.9	6.5	8.0
45.4 million (100 million)	11.4	11.4	11.4	11.8	11.9	12.2	12.8	14.0
227 million (500 million)	52.8	52.8	52.8	53.0	53.1	53.3	53.5	54.1
454 million (1 billion)	75.4	75.4	75.4	75.4	75.4	75.4	75.6	75.9

EXHIBIT 4-35

PERCENT OF TOTAL CHEMICALS MISSED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.38	1.66	1.95	2.53	3.83	4.08
4,540 (10,000)	0.00	0.00	0.46	1.87	2.63	3.70	5.48	5.95
45,400 (100,000)	0.00	0.02	0.53	2.22	3.26	4.92	7.14	7.95
454,000 (1 million)	0.00	0.02	0.55	2.30	3.43	5.40	7.75	8.76
4.54 million (10 million)	0.00	0.02	0.55	2.34	3.48	5.57	8.06	9.13
22.7 million (50 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23
45.4 million (100 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23
227 million (500 million)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23
454 million (1 billion)	0.00	0.02	0.55	2.35	3.52	5.61	8.12	9.23

EXHIBIT 4-36

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS[a]

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.07	0.32	1.04	2.01	3.47	4.84	5.48
4,540 (10,000)	0.00	0.08	0.49	1.48	2.90	5.71	7.60	8.58
45,400 (100,000)	0.00	0.17	0.72	2.17	4.49	8.77	11.3	12.73
454,000 (1 million)	0.00	0.25	1.02	2.80	5.52	10.6	13.8	15.9
4.54 million (10 million)	0.00	0.28	1.16	3.09	6.00	11.6	15.1	17.6
22.7 million (50 million)	0.00	0.32	1.19	3.20	6.23	11.9	15.6	18.4
45.4 million (100 million)	0.00	0.32	1.19	3.20	6.23	12.0	15.8	18.8
227 million (500 million)	0.00	0.32	1.19	3.25	6.28	12.2	16.1	19.4
454 million (1 billion)	0.00	0.32	1.19	3.28	6.32	12.2	16.1	19.5

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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-37

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS[a]

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	TOTAL EMPLOYMENT							
	1	4	6	11	21	51	101	201
0 (0)	0.00	0.32	1.19	3.28	6.32	12.2	16.2	19.6
454 (1,000)	10.8	11.1	11.7	13.1	15.2	19.6	22.2	24.9
4,540 (10,000)	17.7	17.9	18.4	19.5	21.1	24.2	26.3	28.7
45,400 (100,000)	28.2	28.4	28.7	29.3	30.1	31.7	33.1	35.1
454,000 (1 million)	42.2	42.2	42.4	42.7	43.0	43.8	44.5	45.8
4.54 million (10 million)	57.7	57.8	57.8	57.9	58.0	58.4	58.8	59.7
22.7 million (50 million)	72.4	72.4	72.4	72.5	72.5	72.7	72.9	73.5
45.4 million (100 million)	79.6	79.6	79.6	79.7	79.7	79.8	80.0	80.4
227 million (500 million)	94.4	94.4	94.4	94.4	94.5	94.5	94.5	94.6
454 million (1 billion)	97.5	97.5	97.5	97.5	97.5	97.5	97.5	97.5

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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-38

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location must be below both parameters to be exempted.)

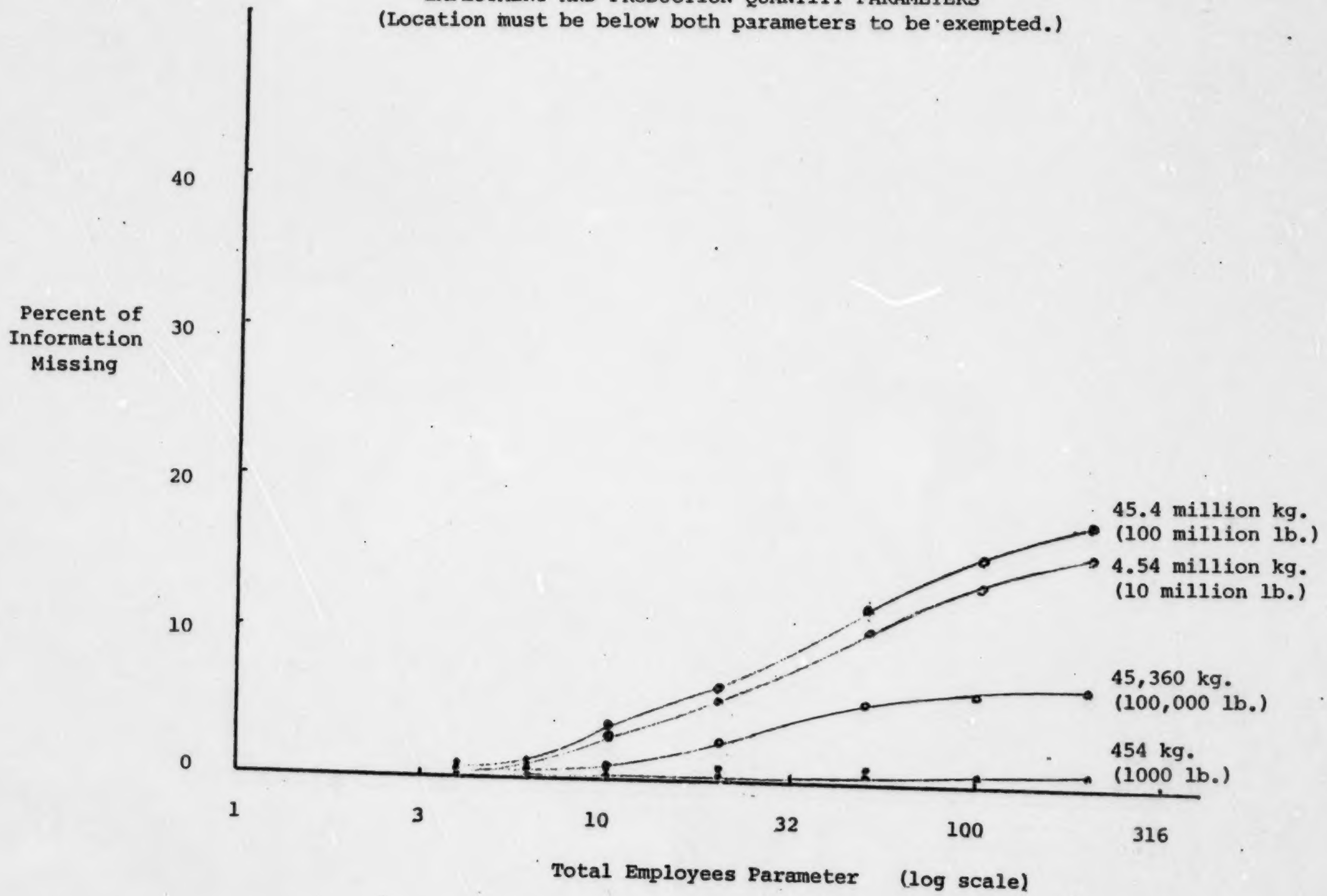


EXHIBIT 4-39

PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location need only be below one parameter to be exempted)

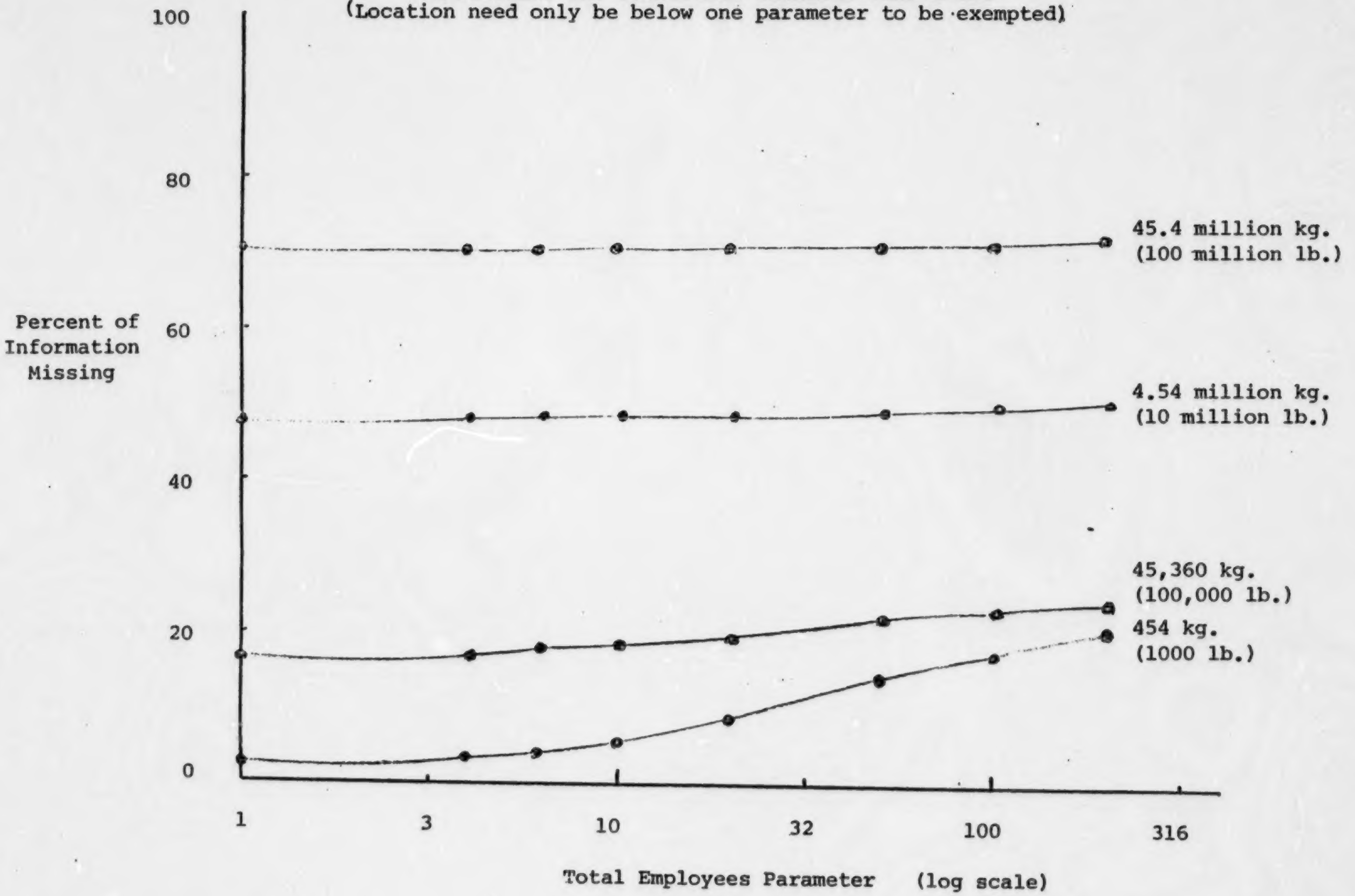


EXHIBIT 4-40

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location must be below both parameters to be exempted)

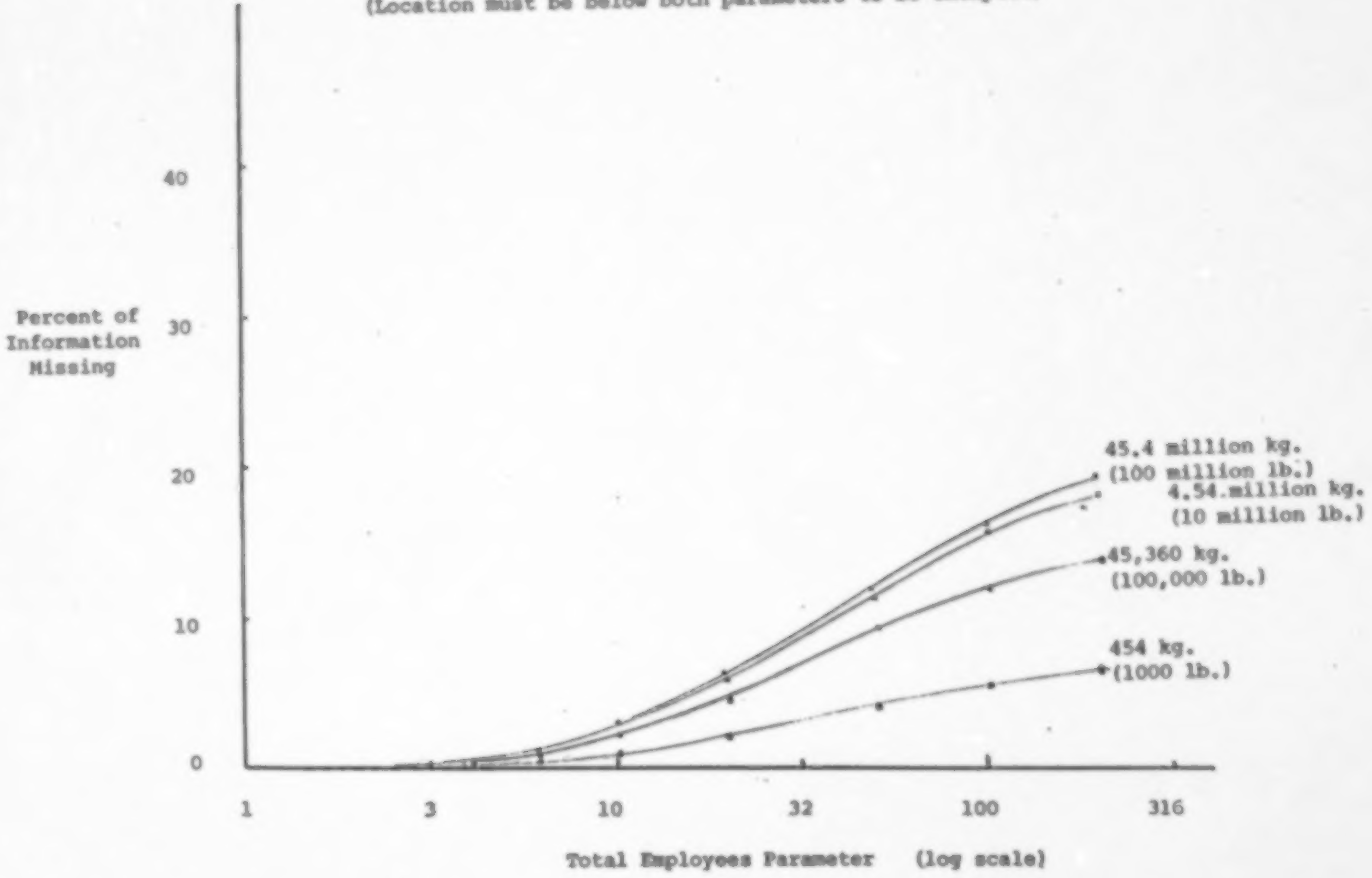


EXHIBIT 4-41

PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location need only be below one parameter to be exempted)

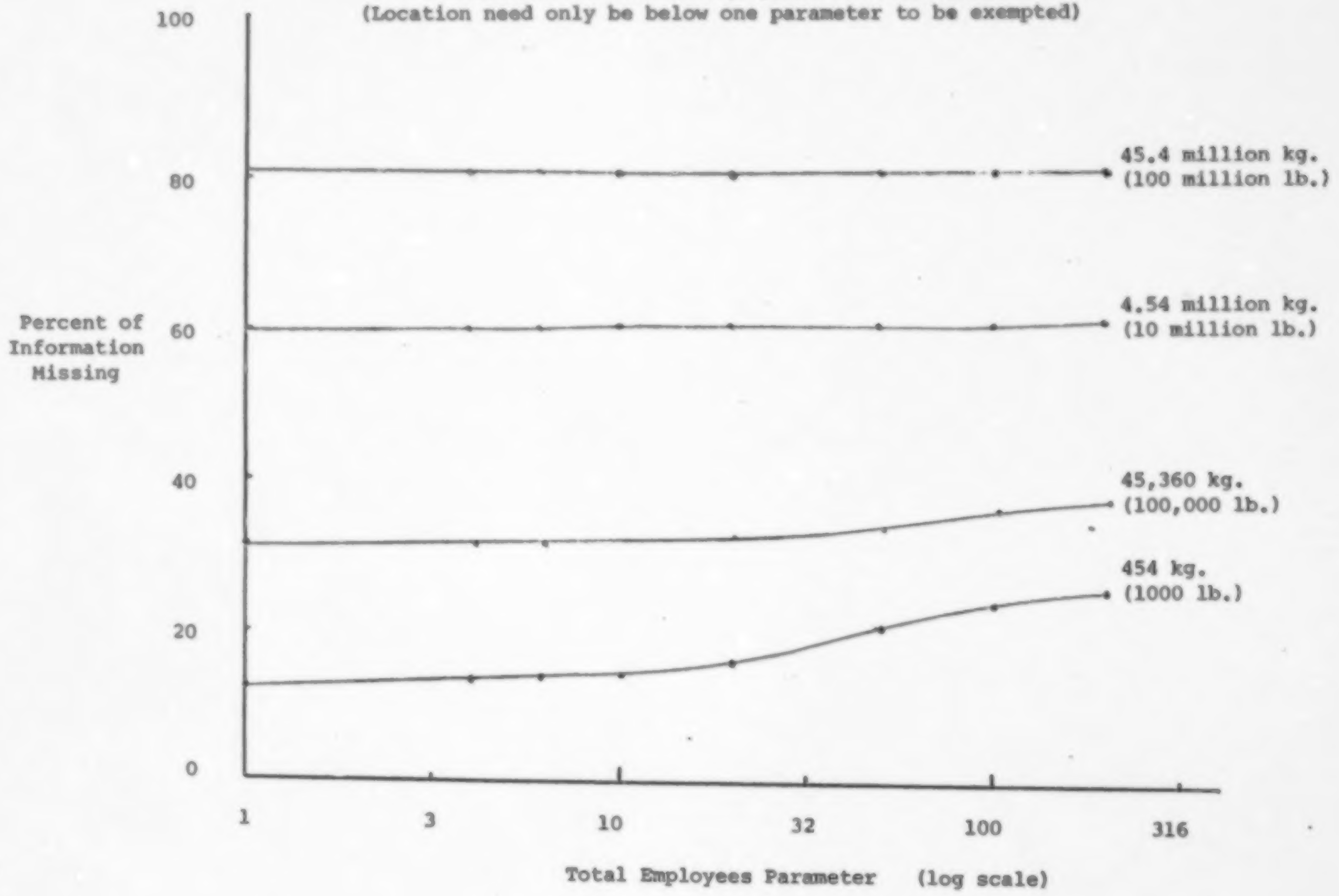


EXHIBIT 4-42

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

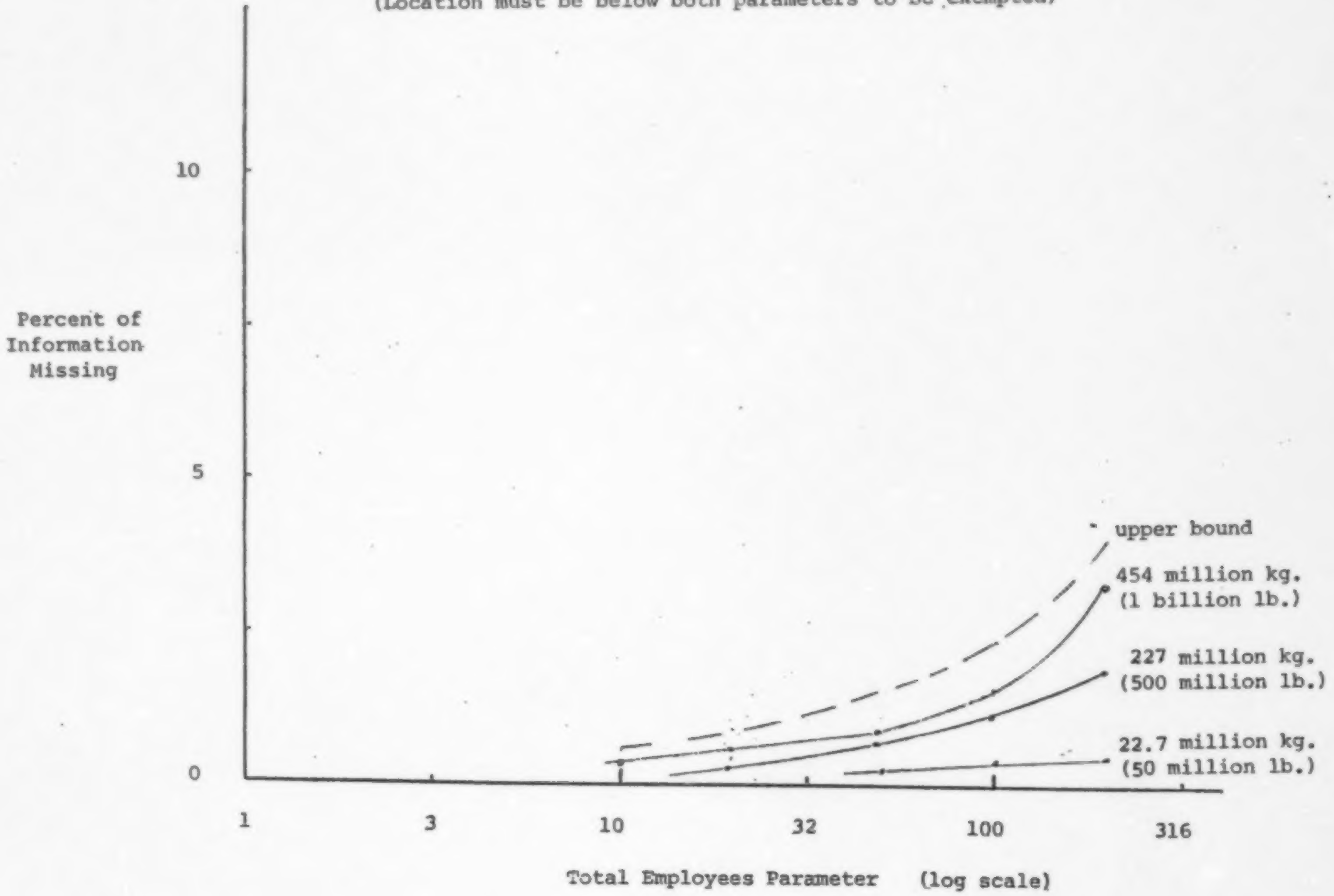


EXHIBIT 4-43

PERCENT OF TOTAL PRODUCTION NOT COVERED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location need only be below one parameter to be exempted)

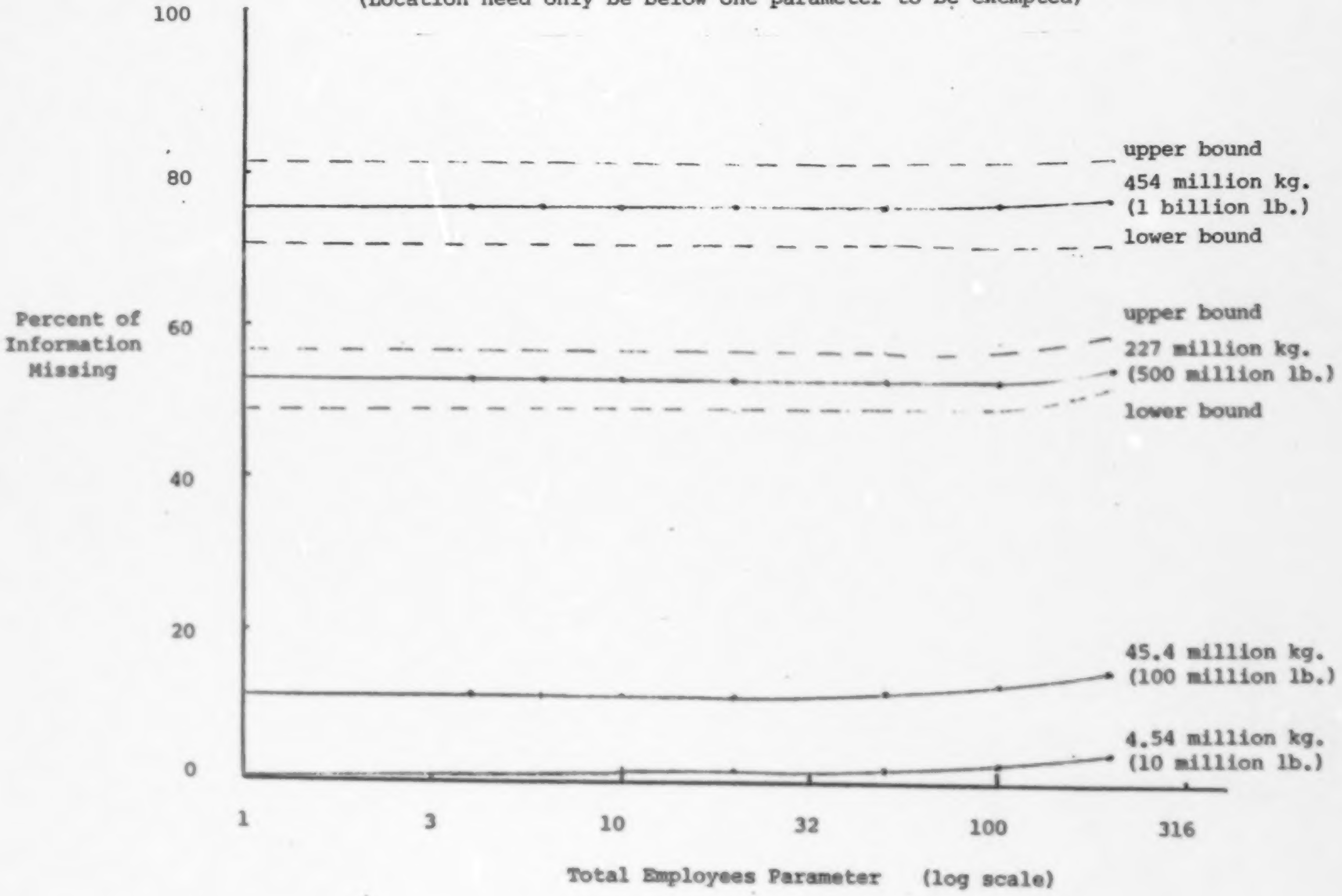


EXHIBIT 4-44

PERCENT OF TOTAL CHEMICALS MISSED FOR VARIOUS EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted

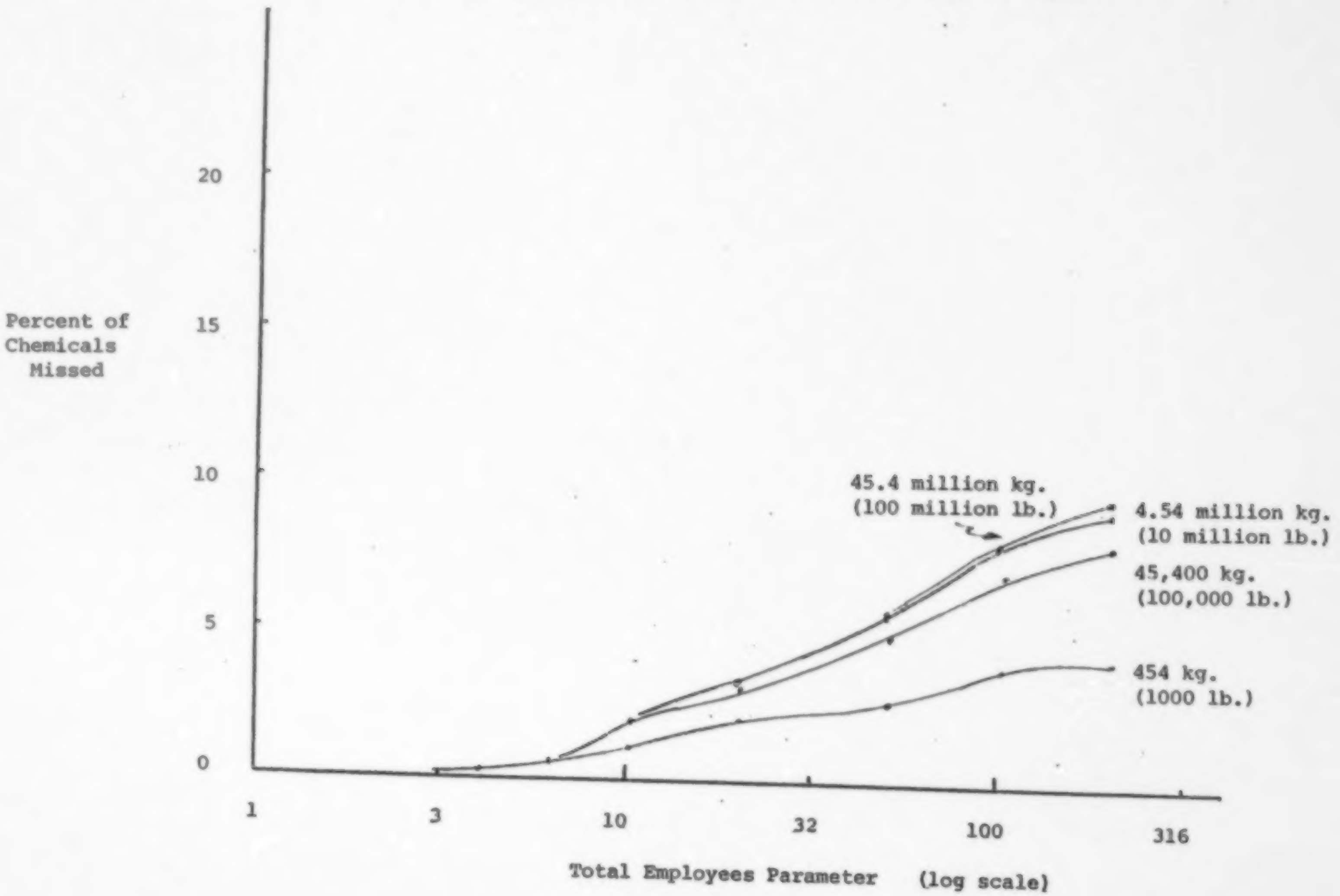
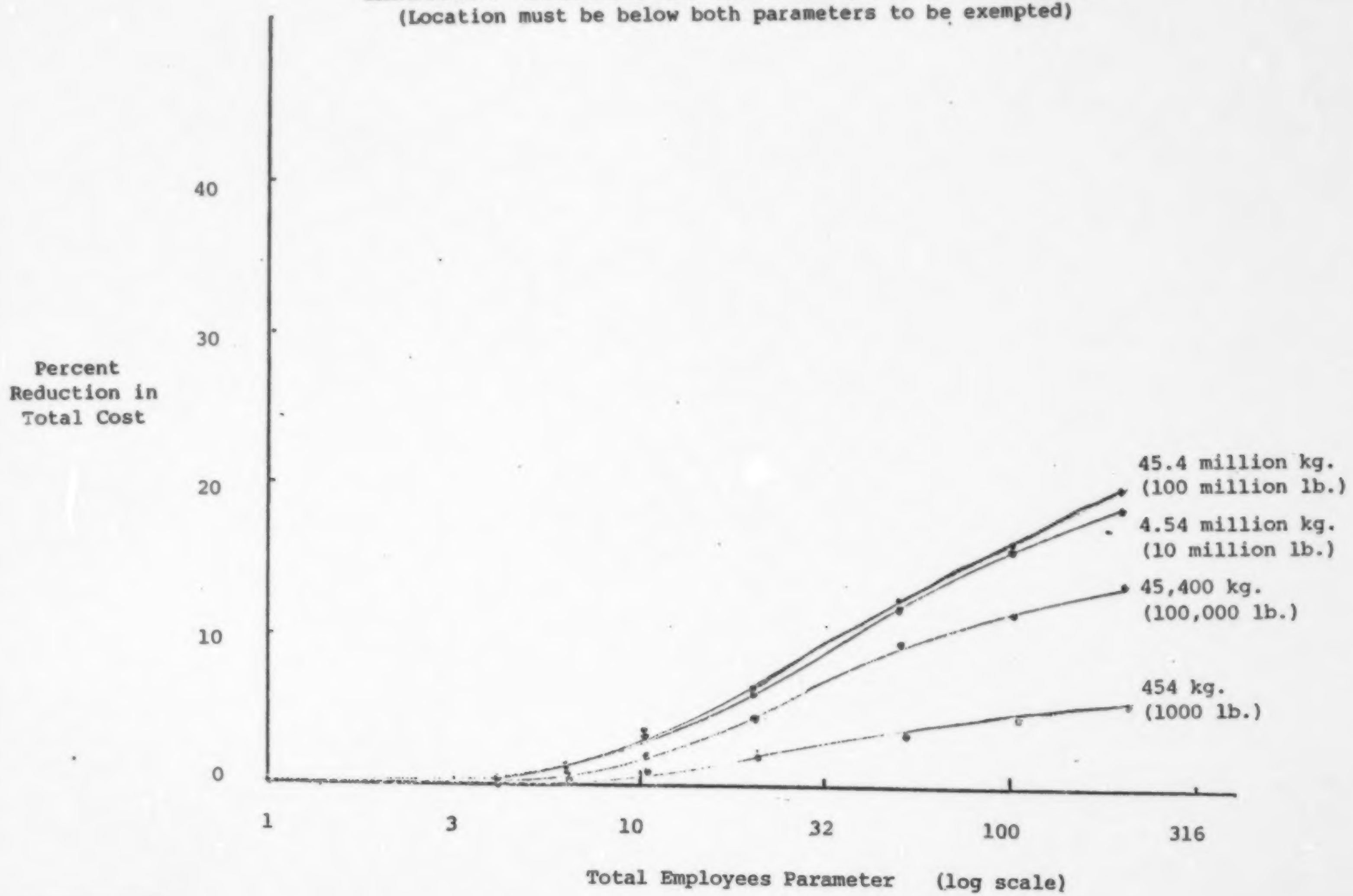


EXHIBIT 4-45

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS[a]
(Location must be below both parameters to be exempted)



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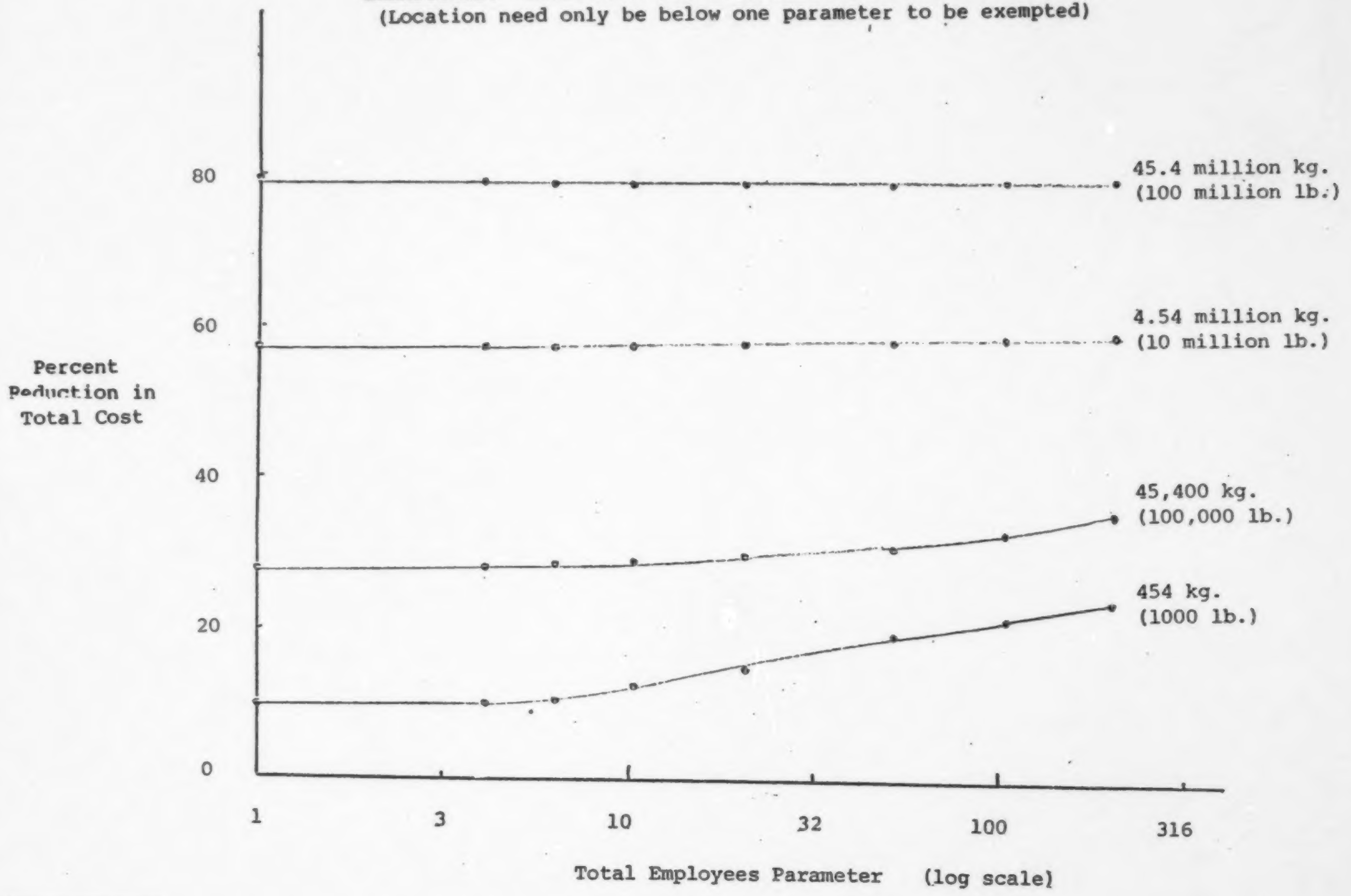
[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-46

PERCENT REDUCTION IN TOTAL COST TO INDUSTRY FOR VARIOUS SMALL MANUFACTURER EXEMPTIONS: EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS[a]
(Location need only be below one parameter to be exempted)



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[a] Cost = (Number of reports required to be prepared) + (Number of locations required to report)

EXHIBIT 4-47

CHANGE IN PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF TOTAL EMPLOYMENT PARAMETER						
	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.27	0.45	0.74	0.29	0.06	0.04	.01
4,540 (10,000)	0.27	0.85	1.3	0.48	0.37	0.10	0.02
45,400 (100,000)	0.43	1.8	2.8	1.5	0.93	0.20	0.06
454,000 (1 million)	1.1	3.3	4.0	2.4	1.3	0.38	0.12
4.54 million (10 million)	1.3	4.6	4.6	2.8	1.6	0.52	0.17
22.7 million (50 million)	1.5	4.7	5.0	3.0	1.7	0.58	0.22
45.4 million (100 million)	1.5	4.7	5.0	3.0	1.8	0.58	0.24
227 million (500 million)	1.5	4.7	5.0	3.0	1.8	0.66	0.31
454 million (1 billion)	1.5	4.7	5.0	3.0	1.8	0.68	0.31

EXHIBIT 4-48

CHANGE IN PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location need only be below one parameter to be exempted)

SHIFT OF TOTAL EMPLOYMENT PARAMETER

PRODUCTION QUANTITY kilograms (pounds)	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	1.5	4.7	5.0	3.1	1.8	0.68	0.32
454 (1,000)	1.0	4.5	4.2	2.8	1.7	0.66	0.31
4,540 (10,000)	1.3	4.0	3.6	2.6	1.4	0.60	0.29
45,400 (100,000)	1.0	2.5	2.2	1.6	0.90	0.48	0.26
454,000 (1 million)	0.33	1.5	1.0	0.70	0.47	0.30	0.20
4.54 million (10 million)	0.33	0.00	0.40	0.30	0.23	0.16	0.14
22.7 million (50 million)	0.00	0.00	0.00	0.10	0.13	0.10	0.10
45.4 million (100 million)	0.00	0.00	0.20	0.00	0.07	0.08	0.08
227 million (500 million)	0.00	0.00	0.20	0.00	0.03	0.00	0.02
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.00	0.01

EXHIBIT 4-49

CHANGE IN PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location must be below both parameters to be exempted)

SHIFT OF TOTAL EMPLOYMENT PARAMETER

PRODUCTION QUANTITY kilograms (pounds)	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.23	1.4	1.7	1.1	0.57	0.34	0.07
4,540 (10,000)	0.27	2.3	2.1	1.6	1.1	0.46	0.11
45,400 (100,000)	0.60	3.0	2.9	2.5	1.6	0.56	0.17
454,000 (1 million)	0.77	3.8	3.4	2.9	1.8	0.70	0.17
4.54 million (10 million)	0.87	4.2	3.8	2.9	1.9	0.74	0.26
22.7 million (50 million)	0.93	4.1	3.8	3.1	1.9	0.78	0.29
45.4 million (100 million)	0.93	4.1	3.8	3.1	2.0	0.80	0.31
227 million (500 million)	0.93	4.1	4.0	3.0	2.0	0.82	0.33
454 million (1 billion)	0.93	4.1	4.0	3.1	2.0	0.80	0.34

EXHIBIT 4-50

CHANGE IN PERCENT OF TOTAL REPORTS NOT REQUIRED TO BE PREPARED PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF TOTAL EMPLOYMENT PARAMETER 1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.93	6.6	3.0	3.1	2.0	0.80	0.35
454 (1,000)	1.0	2.5	2.4	1.9	1.4	0.48	0.27
4,540 (10,000)	0.67	2.0	2.0	1.4	0.93	0.36	0.23
45,400 (100,000)	0.33	1.5	1.0	0.50	0.47	0.24	0.18
454,000 (1 million)	0.00	0.50	0.60	0.20	0.20	0.12	0.11
4.54 million (10 million)	0.00	0.00	0.40	0.10	0.07	0.06	0.08
22.7 million (50 million)	0.00	0.00	0.20	0.00	0.07	0.04	0.05
45.4 million (100 million)	0.00	0.00	0.20	0.00	0.03	0.02	0.03
227 million (500 million)	0.00	0.00	0.00	0.00	0.00	0.00	0.01
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.00	0.01

EXHIBIT 4-51

CHANGE IN PERCENT OF TOTAL PRODUCTION NOT COVERED PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location must be below both parameters to be exempted)

SHIFT OF TOTAL EMPLOYMENT PARAMETER

PRODUCTION QUANTITY kilograms (pounds)	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,540 (10,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45,400 (100,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454,000 (1 million)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.54 million (10 million)	0.00	0.00	0.02	0.01	0.01	0.00	0.00
22.7 million (50 million)	0.00	0.00	0.04	0.04	0.02	0.02	0.01
45.4 million (100 million)	0.00	0.00	0.08	0.03	0.04	0.02	0.03
227 million (500 million)	0.00	0.00	0.42	0.03	0.09	0.09	0.10
454 million (1 billion)	0.00	0.00	0.94	0.12	0.14	0.08	0.14

EXHIBIT 4-52

CHANGE IN PERCENT OF TOTAL PRODUCTION NOT COVERED PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER
(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF TOTAL EMPLOYMENT PARAMETER						
	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	1.0	0.10	0.13	0.14	0.16
454 (1,000)	0.00	0.00	1.0	0.10	0.13	0.14	0.16
4,540 (10,000)	0.00	0.00	1.0	0.10	0.13	0.14	0.16
45,400 (100,000)	0.00	0.00	1.0	0.10	0.13	0.14	0.16
454,000 (1 million)	0.00	0.00	0.80	0.20	0.13	0.12	0.16
4.54 million (10 million)	0.00	0.00	0.80	0.10	0.13	0.14	0.16
22.7 million (50 million)	0.00	0.00	1.0	0.00	0.13	0.12	0.15
45.4 million (100 million)	0.00	0.00	0.80	0.10	0.10	0.12	0.12
227 million (500 million)	0.00	0.00	0.40	0.10	0.07	0.04	0.06
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.04	0.03

EXHIBIT 4-53

CHANGE IN THE PERCENT OF TOTAL CHEMICALS MISSED PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location must be below both parameters to be exempted)

	SHIFT OF TOTAL EMPLOYMENT PARAMETER						
PRODUCTION QUANTITY kilograms (pounds)	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.00	1.9	2.6	0.29	0.20	0.26	0.03
4,540 (10,000)	0.00	2.3	2.8	0.76	0.36	0.36	0.05
45,400 (100,000)	0.07	2.5	3.4	1.0	0.55	0.44	0.08
454,000 (1 million)	0.07	2.6	3.5	1.1	0.66	0.47	0.10
4.54 million (10 million)	0.07	2.6	3.6	1.1	0.70	0.50	0.11
22.7 million (50 million)	0.07	2.6	3.6	1.2	0.70	0.50	0.11
45.4 million (100 million)	0.07	2.6	3.6	1.2	0.70	0.50	0.11
227 million (500 million)	0.07	2.6	3.6	1.2	0.70	0.50	0.11
454 million (1 billion)	0.07	2.6	3.6	1.2	0.70	0.50	0.11

EXHIBIT 4-54

CHANGE IN PERCENT REDUCTION IN TOTAL COST TO INDUSTRY PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location must be below both parameters to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF TOTAL EMPLOYMENT PARAMETER						
	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454 (1,000)	0.23	1.2	1.4	0.97	0.49	0.27	0.06
4,540 (10,000)	0.27	2.0	2.0	1.4	0.94	0.38	0.10
45,400 (100,000)	0.57	2.7	2.9	2.3	1.4	0.51	0.14
454,000 (1 million)	0.83	3.8	3.6	2.7	1.7	0.64	0.21
4.54 million (10 million)	0.93	4.4	3.9	2.9	1.9	0.70	0.25
22.7 million (50 million)	1.1	4.3	4.0	3.0	1.9	0.74	0.28
45.4 million (100 million)	1.1	4.3	4.0	3.0	1.9	0.74	0.30
227 million (500 million)	1.1	4.3	4.1	3.0	2.0	0.78	0.33
454 million (1 billion)	1.1	4.3	4.2	3.0	2.0	0.78	0.33

EXHIBIT 4-55

CHANGE IN PERCENT REDUCTION IN TOTAL COST TO INDUSTRY PER A TEN PERSON INCREASE IN THE EMPLOYMENT PARAMETER

(Location need only be below one parameter to be exempted)

PRODUCTION QUANTITY kilograms (pounds)	SHIFT OF TOTAL EMPLOYMENT PARAMETER						
	1 to 4	4 to 6	6 to 11	11 to 21	21 to 51	51 to 101	101 to 201
0 (0)	1.1	4.3	4.2	3.0	2.0	0.80	0.34
454 (1,000)	1.0	3.0	2.8	2.1	1.5	0.52	0.27
4,540 (10,000)	0.67	2.5	2.2	1.6	1.0	0.42	0.24
45,400 (100,000)	0.67	1.5	1.2	0.80	0.53	0.28	0.20
454,000 (1 million)	0.00	1.0	0.60	0.30	0.27	0.14	0.13
4.54 million (10 million)	0.33	0.00	0.20	0.10	0.13	0.08	0.09
22.7 million (50 million)	0.00	0.00	0.20	0.00	0.07	0.04	0.06
45.4 million (100 million)	0.00	0.00	0.20	0.00	0.03	0.04	0.04
227 million (500 million)	0.00	0.00	0.00	0.10	0.00	0.00	0.01
454 million (1 billion)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EXHIBIT 4-56

ISOQUANTS SHOWING THE PERCENT OF TOTAL LOCATIONS NOT REQUIRED TO REPORT AS A FUNCTION OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

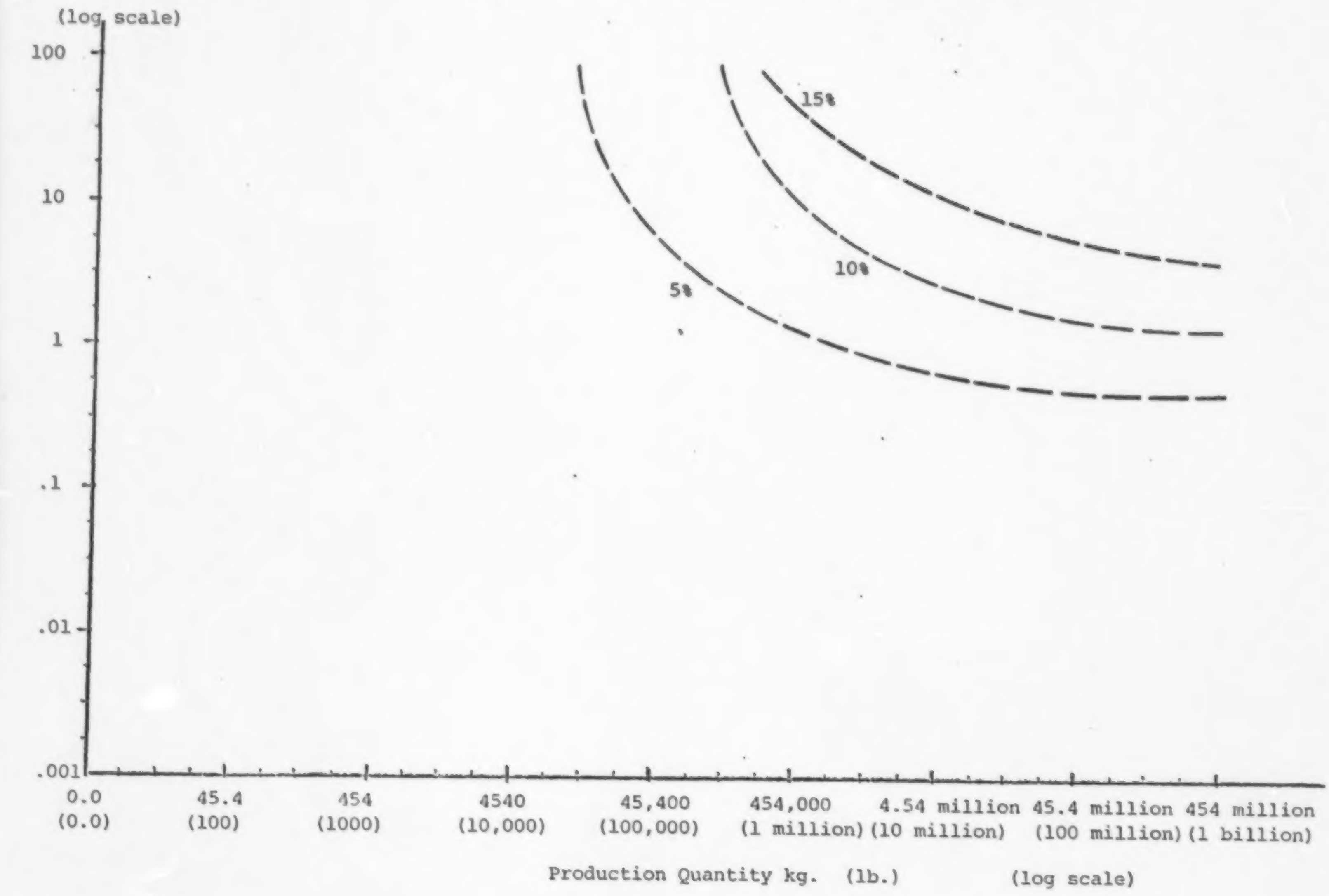

EXHIBIT 4-57

ISOQUANTS SHOWING THE PERCENT REDUCTION IN TOTAL COST TO INDUSTRY AS A FUNCTION OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

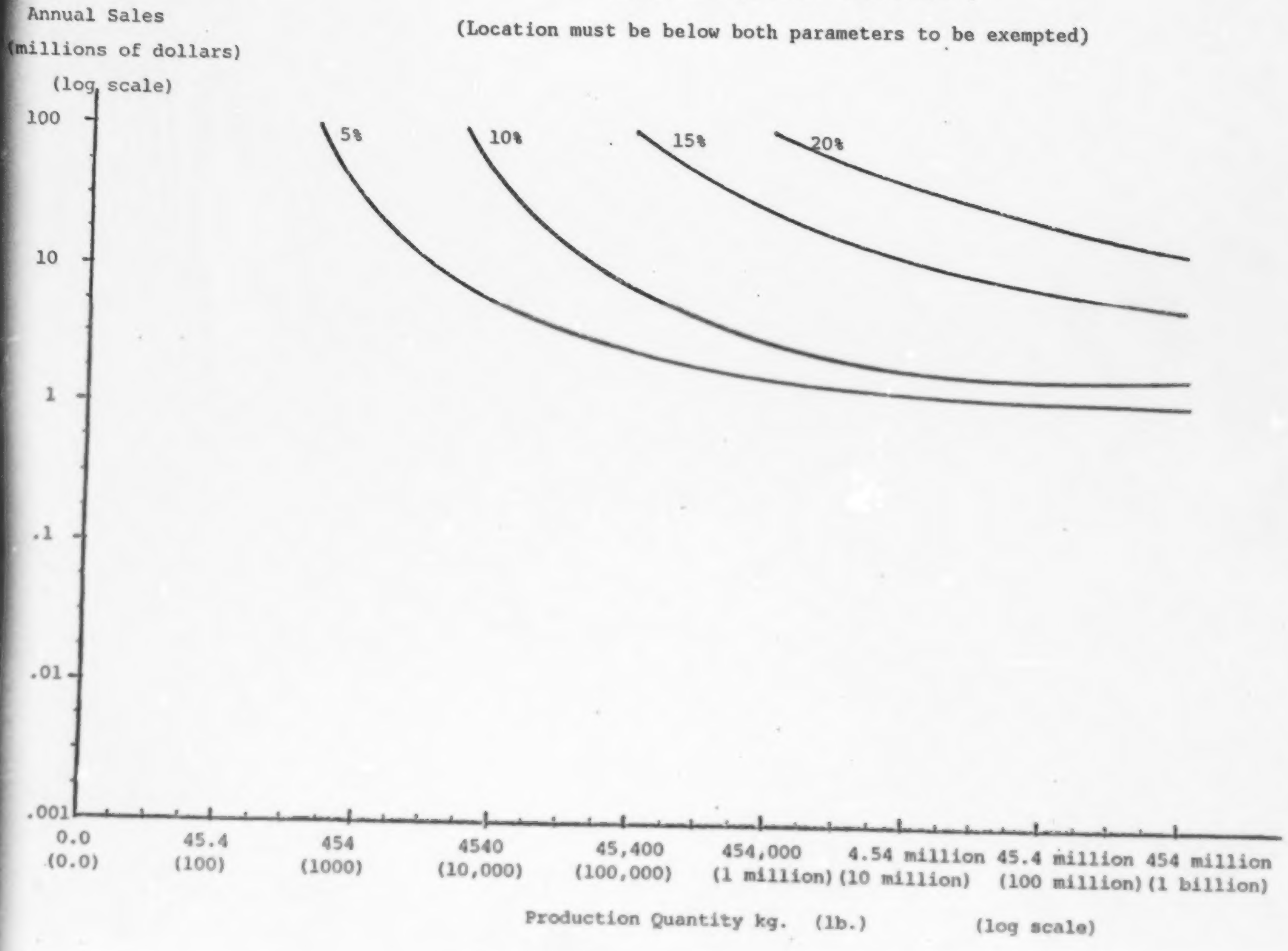

EXHIBIT 4-58

LOCATION AND COST ISOQUANTS GRAPHED TOGETHER AS FUNCTIONS OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Locations must be below both parameters to be exempted)

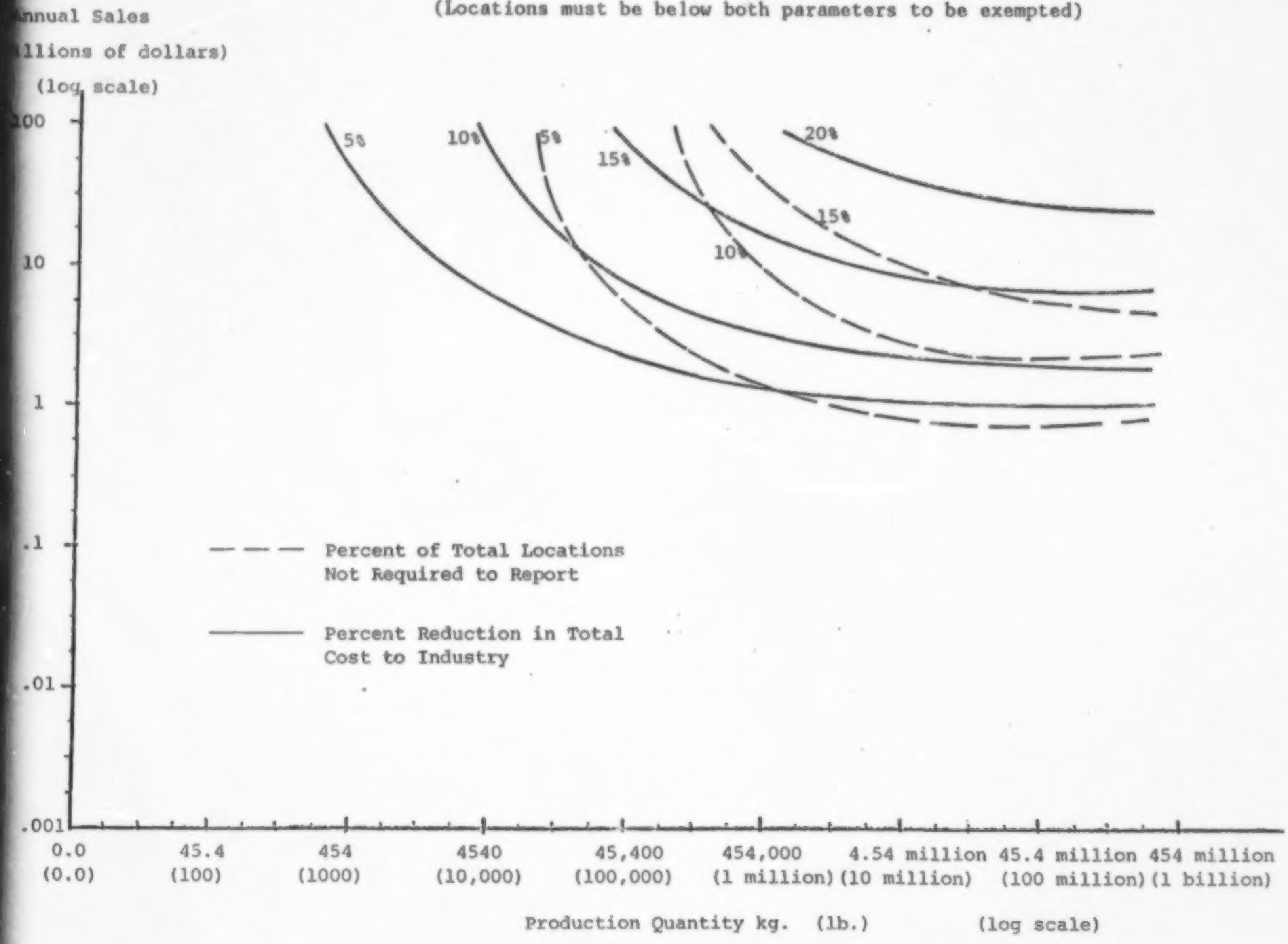

EXHIBIT 4-59

REPORTS AND COST ISOQUANTS GRAPHED TOGETHER AS FUNCTIONS OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

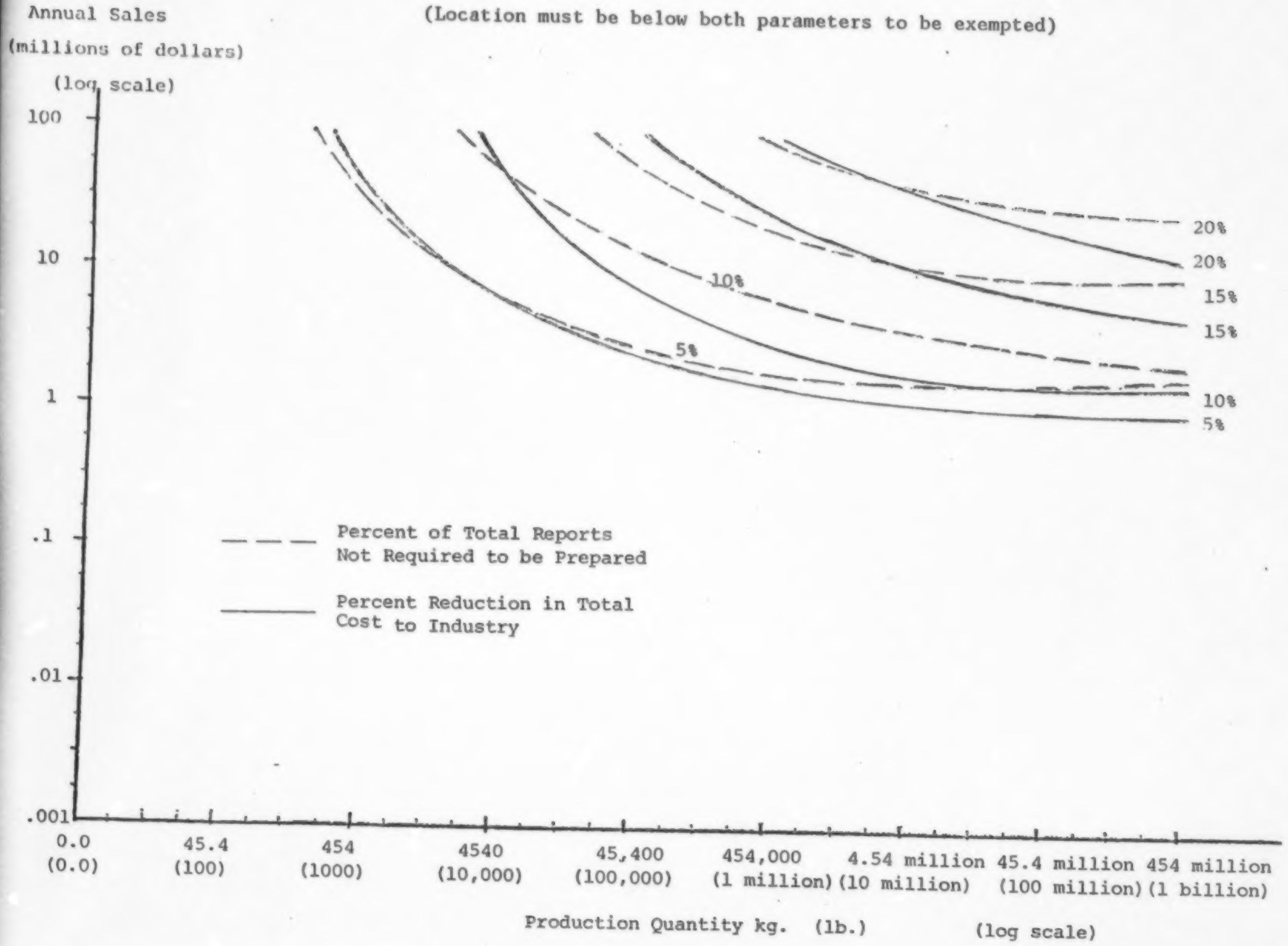

EXHIBIT 4-60

PERCENT OF CHEMICALS MISSED AND COST IOSQUANTS GRAPHED TOGETHER AS FUNCTIONS OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

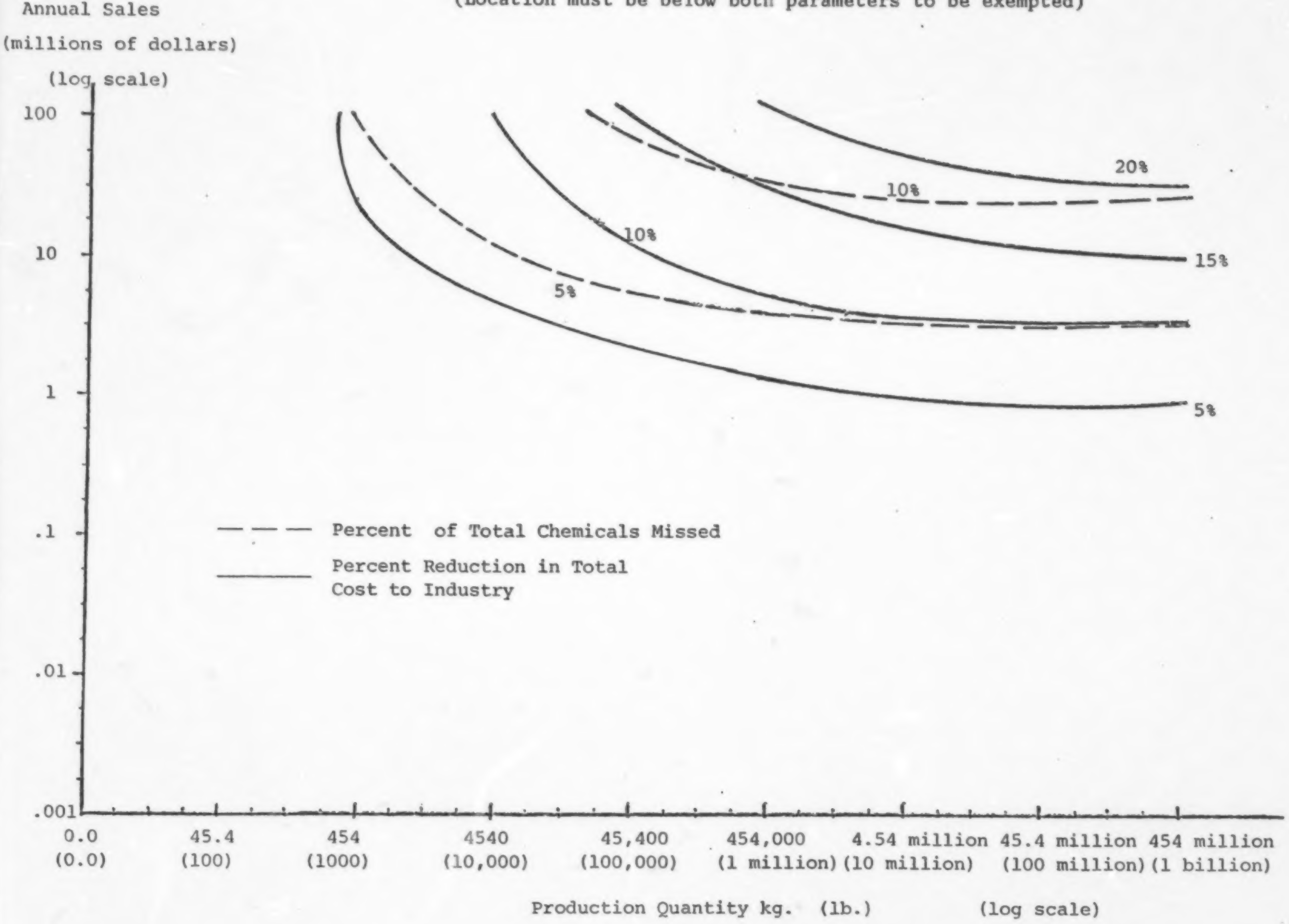

EXHIBIT 4-61

REPORTS AND LOCATIONS ISOQUANTS GRAPHED TOGETHER AS FUNCTIONS OF THE SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

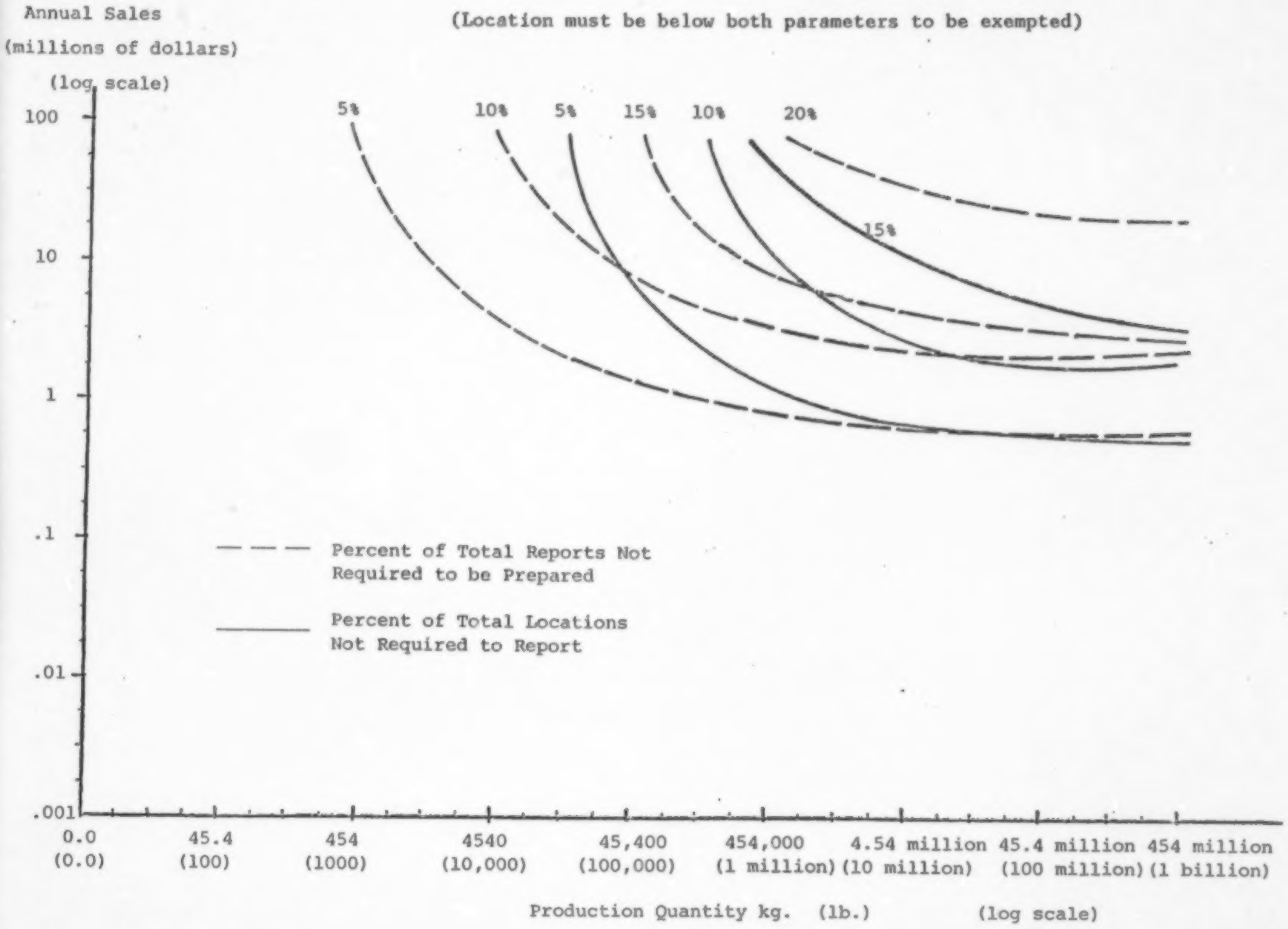

EXHIBIT 4-62

REPORTS AND LOCATION ISOQUANTS GRAPHED TOGETHER TO DEMONSTRATE THE INSENSITIVITY OF THE COST-EFFECTIVENESS CONCLUSION TO ASSUMPTIONS REGARDING THE COEFFICIENTS IN THE COST EQUATION

(Location must be below both parameters to be exempted)

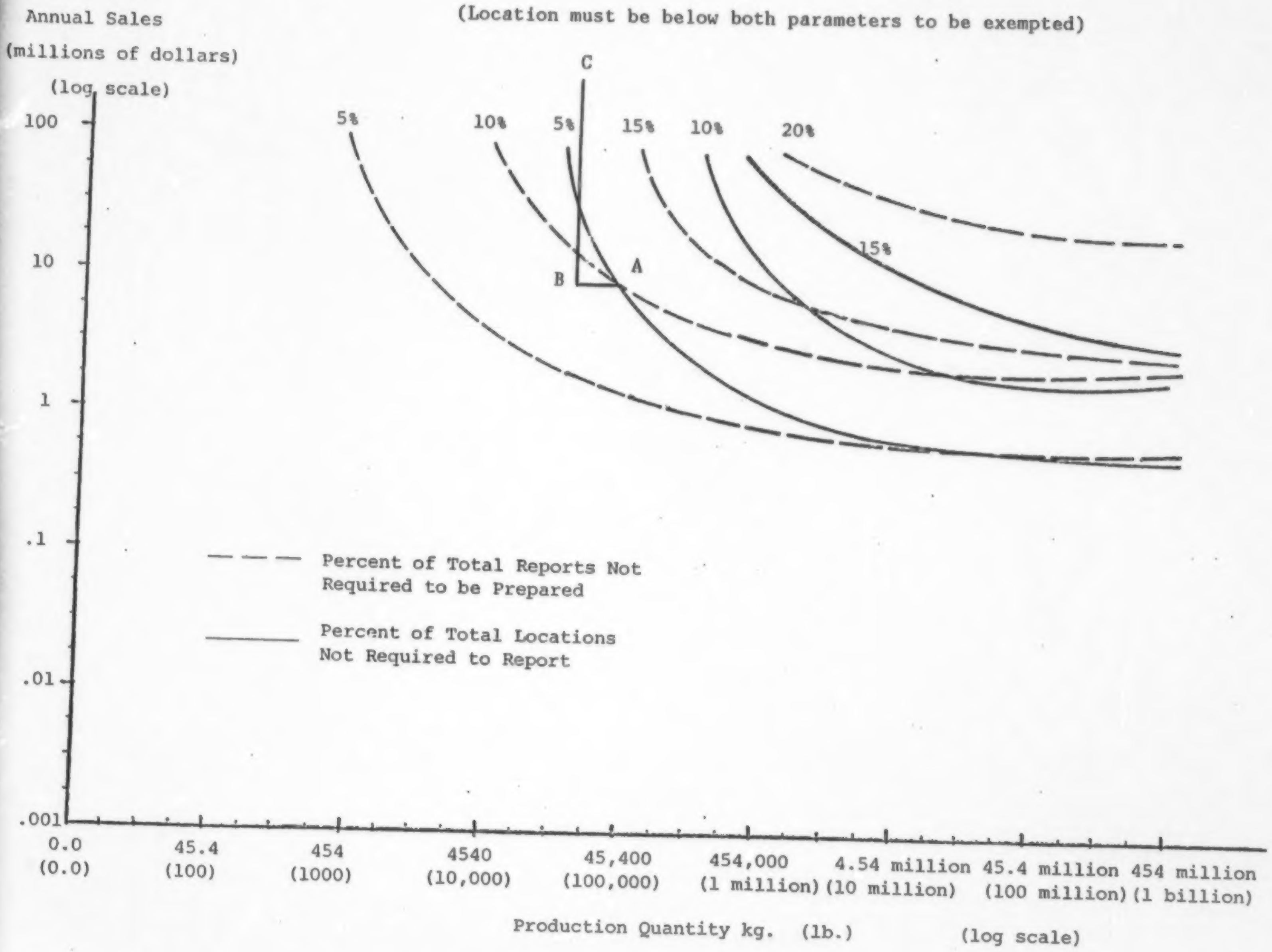

EXHIBIT 4-63

STATISTICS SHOWING THE SIMILARITY OF PRODUCTION REPORTS FOR THE LOCATIONS USED IN THE ANALYSIS AS COMPARED WITH THE TOTAL NUMBER OF LOCATIONS

	All Locations a/		Locations in Analysis b/		
Production Category	Percent of All Records (1)	Percent of Records in 0-9 (2)	Percent of All Records (3)	Percent of Records in 0-9 (4)	$\frac{(3)\text{x}15,416}{(1)\text{x}19,485}$ (5)
BLANK	22.1	-	22.6	-	81.2
N	11.1	-	10.8	-	76.7
0	7.8	11.6	8.5	12.7	86.2
1	5.1	7.7	5.0	7.5	77.1
2	7.7	11.5	7.2	10.8	74.0
3	9.6	14.4	9.1	13.6	70.6
4	10.8	16.1	10.2	15.3	75.0
5	9.7	14.6	9.5	14.3	77.5
6	4.6	6.9	4.8	7.2	81.8
7	8.5	12.7	9.3	13.9	86.3
8	1.6	2.4	1.7	2.6	85.7
9	1.4	2.1	1.3	2.0	76.9

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a/ Total number of locations = 3778
Total number of reports = 19,485

b/ Total number of locations = 3044
Total number of reports = 15,416

EXHIBIT 4-64

COMPARISON OF THE DISTRIBUTION OF REPORTS IN PRODUCTION CATEGORIES N AND BLANK TO THE DISTRIBUTION OF REPORTS IN PRODUCTION CATEGORIES 0 THROUGH 9

Sales Category (million of dollars)	Percent of Total Reports of Production in Categories 0 through 9[a] (%)	Percent of Reports of Production in Category N[b] (%)	Percent of Reports of Production in Category BLANK[c] (%)
0-.1	0.12	0.42	0.09
.1-.5	1.24	1.87	2.74
.5-1.0	2.69	4.28	4.01
1.0-2.5	2.20	7.66	4.10
2.5-5.0	3.64	12.55	5.99
5.0-10	4.41	5.91	5.53
10-20	2.43	1.02	2.15
20-30	2.97	1.87	3.21
30-50	1.96	2.59	4.12
50-100	4.27	5.3	2.41
100	74.07	56.51	65.66

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[a] Total number of reports = 10,266

[b] Total number of reports = 1,658

[c] Total number of reports = 3,492

5. ANALYSIS OF OPTIONS

5.1 INTRODUCTION

EPA can set the small manufacturer exemption for Section 8(a) in a variety of ways, including:

- set the exemption on a case-by-case basis for each rule promulgated under Section 8(a);
- set one exemption level for all future Section 8(a) rules;
- set a base exemption level below which locations are always exempt, but retain the option of exempting additional locations on a case-by-case basis;
- set a ceiling exemption level above which locations must always report, but retain the option of requiring additional locations to report on a case-by-case basis; and
- set a series of tiered exemption levels that would apply to different types of rules promulgated under Section 8(a).

The choice of the number and type of parameters to use must also be made.

This chapter analyzes these options within the framework discussed in Chapter 2, and the information requirements of future Section 8(a) rules discussed in Chapter 3. The results of the data analyses presented in Chapter 4 are used to evaluate the options and to highlight the implications of setting the exemption(s) in various ranges.

The remainder of this chapter is divided into three sections, Section 5.2, Choice of Number and Type of Parameters, analyzes whether it is preferred to set an exemption for which locations need to be below both parameters of the exemption or just one parameter in order to be exempted. This section also analyzes whether total employment can be substituted for annual sales as a parameter to indicate corporations' abilities to absorb reporting costs.

Section 5.3, One-Level Exemption, analyzes the implications of setting a single small manufacturer exemption for all future Section 8(a) reporting rules. A one-level exemption provides the most certainty to industry; locations will either always have to report, or will always be exempt from reporting.

Section 5.4, Multi-Level Exemption, analyzes the implications of allowing the exemption level to vary. We do not draw sharp distinctions between the case-by-case, base, ceiling, and tiered exemption approaches. These options are similar in that they provide the Agency increased flexibility over the one-level exemption, but they also reduce the certainty to industry.

5.2 CHOICE OF NUMBER AND TYPE OF PARAMETERS

EPA can use a variety of parameters to define small manufacturers for the purposes of the Section 8(a) small manufacturer exemption. We examined production quantity at the manufacturing location, annual sales of the parent corporation, and total employment of the parent corporation as parameters. This section is directed toward the choice of how many and which parameters to use.

The production quantity of a specific chemical does not necessarily indicate the "size" of a manufacturer, because a small manufacturer may produce as much or more of a particular chemical as a large diversified corporation. However, production quantity is assumed to be an important parameter of the small manufacturer exemption because it may be an indicator of the potential for exposure to the chemical. It may be important not to exempt reporting on large production quantity chemicals, regardless of the annual sales or total employment of manufacturers, in order to protect human health and the environment. Therefore, production quantity is the first parameter of the exemption.

The choice of whether to add a second parameter can be analyzed using the results presented in Chapter 4. From Exhibit 4-9, one sees that if only production quantity were used as a parameter for the definition, the total cost to industry would be reduced approximately 10.8 percent if it were set at 454 kilograms (1000 pounds). Under this exemption, all manufacturers who produced the chemicals included in the rule in quantities greater than 454 kilograms would have to report.

In Exhibit 4-8, one sees that a 10 percent reduction in total cost to industry can also be accomplished with any number of combinations of two parameters; for example, the production quantity parameter could be set at 45,400 kilograms (100,000 pounds) with the sales parameter at $10 million. In this case, the manufacturing locations must be below both parameters in order to be exempted.

Although the total cost to industry is approximately the same for these two exemption levels, the exemptions are not equivalent. To evaluate which type of exemption is preferred, we examined the proxies for benefits and the distribution of the reporting burdens among the smallest manufacturers in our data base. The manufacturers among which the distribution of the reporting burden was examined were the 600 manufacturing locations reported as having annual sales under $100 million. These represent approximately twenty-five percent of the locations used in the analysis.

With the 454 kilogram exemption, 2.8 percent of the locations and 12.7 percent of the reports would be exempted; and 12.5 percent of the chemicals would be missed completely. With the two-parameter exemption set at 45,400 kilograms and $10 million, 7.1 percent of the locations and 10.7 percent of the reports would be exempted; and 7.1 percent of the chemicals would be missed completely. Production not covered is virtually zero for both exemptions. The one-parameter exemption may be preferred only on the basis of a larger number of different locations having to report for a given level of total cost to industry. However, the cost of these additional locations being required to report is borne almost entirely by the smallest manufacturing locations.

The one-parameter exemption only exempts 7 percent of the locations and 29 percent of the reports of manufacturers with under $100 million in annual sales. The two parameter exemption targets more of the costs toward manufacturers with larger annual sales by exempting 28 percent of the locations and 41 percent of the reports of those under $100 million. The total cost to the 600 locations under $100 million is reduced by over 18 percent.

The two-parameter exemption also redistributes some cost among the 600 locations. The 360 locations with annual sales under $10 million all experience reductions or no change in reporting requirements. Of the 240 locations with annual sales between $10 million and $100 million, thirteen additional locations are required to report and the average number of reports per location increases from approximately four to five. The manufacturers in this range will experience no change or a small increase in their reporting requirements.

The two-parameter exemption therefore allows one to more accurately target the reporting burden toward those manufacturers most able to absorb reporting costs, i.e., those with larger annual sales. The level of the two-parameter exemption can be set to maximize any of the benefit proxies for a given cost constraint as described in Chapter 4. The level of the exemption depends on balancing the value of additional information against the additional cost of obtaining it. Regardless of the level chosen, however, two parameters enables the burden on small manufacturers to be as small as possible given the amount of information desired. A production parameter alone does not sufficiently target the reduction in reporting costs, and a sales parameter alone does not satisfy EPA's information needs.

This analysis also holds for the choice between requiring that locations be below either or both parameters to be exempted under a two-parameter exemption. A one-parameter exemption is actually a special case of the two-parameter exemption when locations need only be below one parameter to be exempted. Therefore, a two-parameter exemption requiring that locations be below both parameters in order to be exempted is preferred.

Annual sales and total employment of the parent company were two parameters examined to accompany the production parameter for the small manufacturer exemption. The sales quantity was chosen as a measure reflecting the ability of corporations to absorb reporting costs. A measure of this sort enables the reporting exemption to be targeted toward those manufacturers that would be most adversely affected by increased costs imposed by government reporting requirements.

Annual sales was chosen as an indicator of manufacturers' profits, and its use implicitly assumes that profit margins are constant throughout the industry and that corporations with larger profits are better able to afford reporting costs. Neither assumption is completely true; profit margins will vary across manufacturers and over time, and profits are not the only indicator of the financial state of a corporation. However, given constraints on the availability of verifiable information, these assumptions and these data probably provide the most reasonable method of assessing the ability of corporations to absorb reporting costs. To the extent that these assumptions are correct, the annual sales parameter is useful in minimizing the adverse effects that the reporting requirements will have on industry.

Annual sales as an exemption parameter may require indexing to account for inflation because the Section 8(a) exemption is expected to be used over a period of years. Two important issues regarding indexing are the choice of the standard index and the timing of indexing. The Bureau of Labor Statistics (BLS) and the Bureau of Economic Analysis both publish price indexes. Seasonally adjusted producer price indexes for various industries (i.e., commodity groupings) and stages of production (i.e., finished goods, intermediate goods, and crude materials) are available from BLS on a regular basis along with the familiar producer and consumer price indexes. For analysis of price trends, stage-of-processing indexes may be more useful than commodity-grouping indexes.[1] Commodity-grouping indexes can exaggerate signals of price changes by reflecting the same price movement through various stages of processing. For example, a price increase in a raw material could be counted in the overall producer price index three times:
1) as the raw material price increase; 2) as the price increase in the intermediate good resulting from the raw material price increase; and 3) as the commensurate final good price increase. The stage-of-processing indexes would each show the increase once, and may avoid any potential exaggeration of price movements. Therefore, although a producer price index for "chemicals" is available, the intermediate-products (less foods and feeds) producer price index published by the BLS may be preferred. This assumes that the chemicals about which information will be collected under Section 8(a) are intermediate, as opposed to finished or crude, materials.

Because the sales parameter investigated here is based on annual sales, there is no need to index more than once a year. In fact, the parameter could be updated less frequently by using a base year of sales, e.g., 1980, for two years and then indexing to a 1982 sales cut-off level. Less frequent indexing fails to exempt firms that shrink below the cut-off during the period between indexing, and fails to require reporting from the appropriate growing firms. The opportunity for such errors may be small for a period as short as two years.

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[1] Bureau of Labor Statistics, Producer Prices and Price Indexes Data for April 1981 (Washington, D.C.: June 1981 [ISSN 0161-7311]), p. 88.

Total employment was investigated as a substitute for annual sales as a parameter of the small manufacturer exemption. Employment is not related conceptually to corporations' abilities to absorb reporting costs. However, if the same locations can be exempted using either parameter, then total employment could be used and indexing would be avoided.

The results of the analysis are that although total employment and annual sales are generally well correlated, in the relevant range of definitions under consideration total employment is not a good predictor of annual sales. Therefore, total employment cannot be used to exempt the same locations as the annual sales parameter. The analysis below demonstrates this result.

A random sample of 250 locations was drawn from the total number of 3044 locations for which all employment and sales data are known. Exhibit 5-1 displays a plot of sales (in millions of dollars) versus employment for these locations. As Exhibit 5-1 shows, employment and sales are generally well correlated. Regressing sales on employment results in:

(1) Sale = 186,600,000 + 81,900 (Employment); $R^2 = 0.541$; and

(2) Sale = 85,200 (Employment); $R^2 = 0.536$.

Regression equation (2) is constrained to go through the origin. Both equations are shown in Exhibit 5-1.

The relevant range of exemptions under consideration is in the bottom left-hand corner of Exhibit 5-1. Exhibit 5-2 enlarges that corner by plotting sales versus employment for only those locations with annual sales under $100 million. Again, sales and employment appear to be generally well correlated, and the regression equations are:

(3) Sale = 5,900,000 + 45,000 (Employment); $R^2 = 0.681$; and

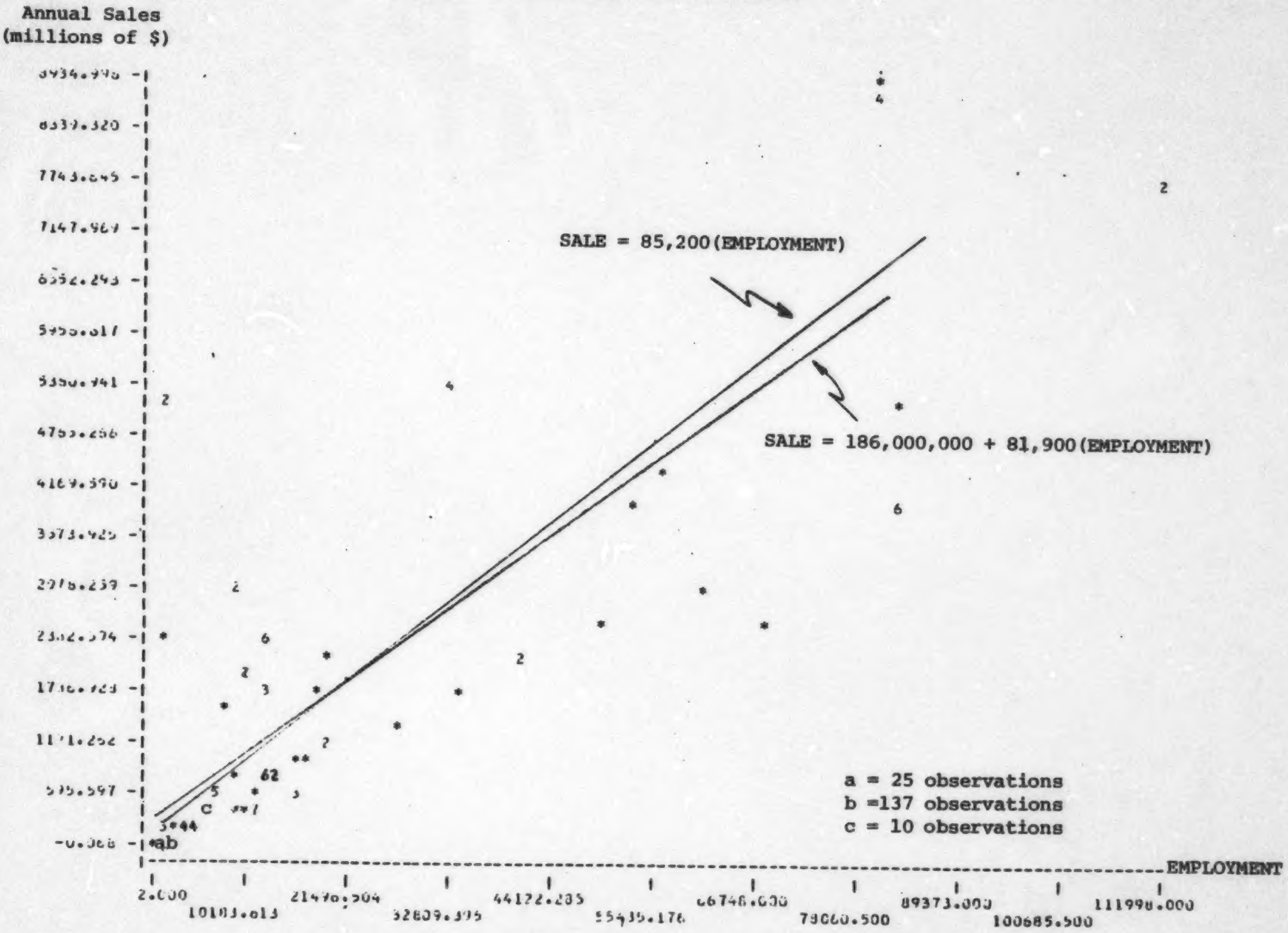
(4) Sale = 50,900 (Employment); $R^2 = 0.621$.

Regression equation (4) is constrained to go through the origin.

For locations with annual sales under $100 million, total employment varies to as high as approximately 1800 employees. More importantly, the locations with annual sales between $30 million and $100 million also have total employment figures that vary widely. Employment does not appear to correlate well with sales for those locations in this sample with annual sales in this range. Exhibit 5-2 also shows that locations with sales between $30 million and $100 million generally have employment figures of greater than 500 employees. To exempt these locations with an employment parameter, the employment parameter would have to be set so high that locations with annual

EXHIBIT 5-1

PLOT OF TOTAL ANNUAL SALES VERSUS TOTAL EMPLOYMENT
(Sample of 250 locations)

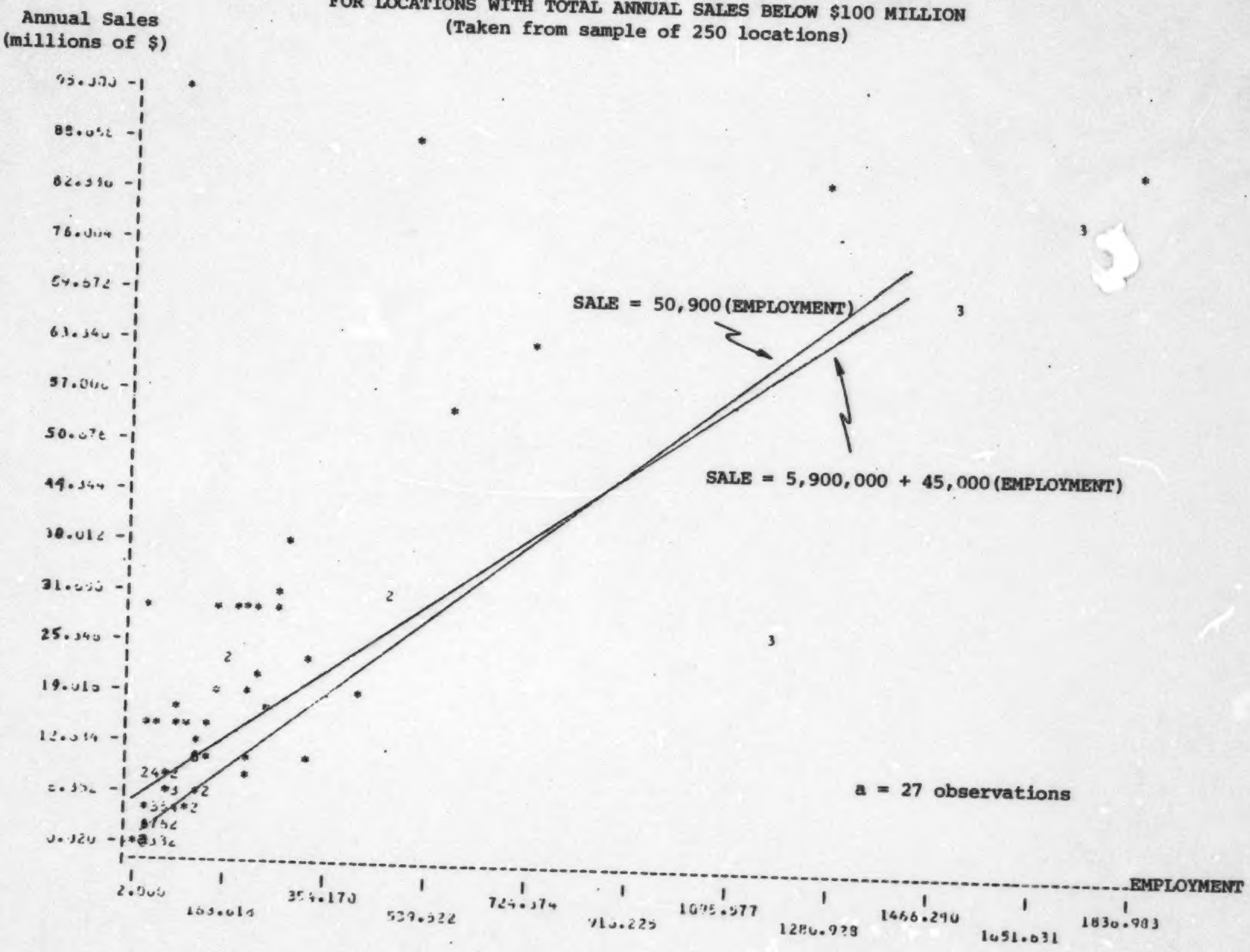


5-6

EXHIBIT 5-2

PLOT OF TOTAL ANNUAL SALES VERSUS TOTAL EMPLOYMENT FOR LOCATIONS WITH TOTAL ANNUAL SALES BELOW $100 MILLION

(Taken from sample of 250 locations)



sales much greater than $100 million would also be exempt. This result can be seen from Exhibit 5-1. Therefore, in the sales parameter range of $30 million to $100 million, employment does not reflect corporations' abilities to absorb the costs of reporting.

In the sales range below $30 million, the same problem exists. To exempt all the appropriate locations in this sales range, the employment parameter must be set so high that locations with sales over $30 million are exempted. By lowering the employment parameter to correct for this, many locations with low sales are not exempted.

For a specific set of production quantity and sales parameters, a more detailed analysis can explore what employment level options can be substituted for the given sales level, and can examine the exact effects each option has on the locations required to report. In general, employment is not a good substitute for sales as a parameter of the small manufacturer exemption. Therefore, the remainder of this chapter analyses the one-level and multi-level options for exemptions set with production quantity and annual sales parameters.

5.3 ONE-LEVEL EXEMPTION

A one-level exemption for all future Section 8(a) reporting rules is the least flexible option evaluated here. Regardless of the varying information requirements of the expected rules discussed in Chapter 3, manufacturers below the exemption would always be exempt, and those above would always be required to report. However, a one-level exemption also provides the greatest certainty to industry. This increased certainty to industry can be balanced off against the opportunities to reduce reporting costs to industry in some cases by requiring less reporting; and to increase reporting costs in other cases by requiring more reporting.

Industry's relative valuation of the certainty of reporting versus unknown future reporting requirements is not assessed here. Instead, this option is evaluated in terms of its implications for setting an exemption level that enables EPA to obtain all the information required for future 8(a) rules. The cost that setting this level could be expected to impose on industry is also examined.

A one-level exemption is most appropriate if all future rules will require approximately the same coverage of manufacturers. To the extent that the desired coverage varies significantly across rules, a one-level exemption may include too many manufacturers for one rule or too few for another. For purposes of the analysis that follows, we assume that a one-level exemption should be set so as to meet the strictest coverage requirements of potential future Section 8(a) rules. Just how much coverage is sufficient is a judgment for the Agency to make. In the following example we demonstrate how the reports and locations proxies can be used to set an exemption level for a group chemical rule.[2]

As shown in Chapter 4, to maximize the number of locations for a given cost constraint, "low" production quantity and "high" sales parameters should be used. To maximize the number of reports, the opposite is true. Because both proxies may be important in the evaluation of a rule, a "middle" approach may at first glance seem appropriate. However, the importance of obtaining information representative of the wide range of sales categories, be it in terms of the number of reports prepared or the number of locations reporting, also influences the choice of the appropriate range of parameters to consider.

Exhibit 5-3 shows that at point A, a "low" production quantity parameter and "high" sales parameter combination ensures more representative information for a given cost. The points A and B in Exhibit 5-3 are assumed to impose the same total cost on industry. The locations in the shaded region are exempt under either definition. Point A additionally exempts locations in area S_1S_2AX; and Point B additionally exempts locations in area P_1P_2BX.

If the exemption were set at B, nearly all the locations with total firm sales under S_1 would not have to report because P_2 is set "high". Short of setting S_1 close to zero, which would impose a large burden on industry as a whole including small manufacturers, very little or no information would be received from the small locations in the industry, even if they have moderately high production (between P_1 and P_2). By setting the exemption at A, additional information on production above P_1 is received for a loss of some information on production below P_1. The additional information both increases the representativeness of the information to a wider range of sales categories, and focuses on moderate to high production quantities. Setting the exemption at A spreads the reduction in reporting costs among more sales categories. Also, the reporting that is exempted is primarily on very low production chemicals that may be of less importance. (The way the data support this analysis is discussed below.)

Point A may also be preferred on equity grounds. Locations below S_1 may produce a fair number of moderate quantity chemicals (between P_1 and P_2) that compete with moderate quantity chemicals produced by medium sized firms (between S_1 and S_2). Point B could give the smallest firms an unwarranted advantage over the medium sized firms. Therefore, Point A is again preferred.

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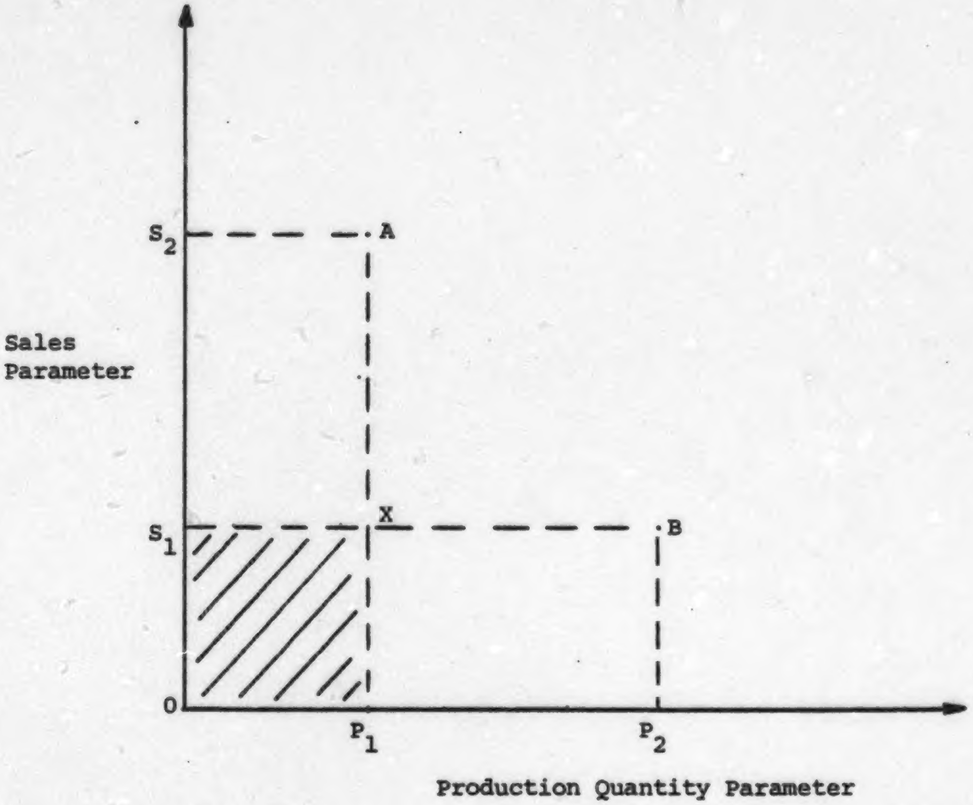
[2] The example analyzed here is for a hypothetical reporting rule that requires reporting on a group of chemicals similar to the group used as data for this report. As discussed in Chapter 4, the results of the data analyses presented here may not hold for groups of chemicals or individual chemicals that are not representative of the data examined here.

EXHIBIT 5-3

COMPARISON OF THE REPRESENTATIVENESS OF INFORMATION RECEIVED UNDER A "LOW PRODUCTION/HIGH SALES" EXEMPTION (POINT A) VERSUS A "HIGH PRODUCTION/LOW SALES" EXEMPTION (POINT B)



Sales Parameter
S_2
A
X
S_1
B
0
P_1
P_2
Production Quantity Parameter

If production processes vary systematically across the chemical industry in such a way so as to make representativeness an important criterion to consider, then a "low" production/"high" sales range seems most appropriate for the one-level exemption. The reports proxy still holds, but for the information to be valuable it may have to be representative.[3]

Just how low and high the parameters should be set depends on the value of the information relative to the cost of obtaining it. We have not assigned values to the information. However, by choosing an exemption level in the appropriate range, and examining how the information obtained and the reporting burden vary as one varies the exemption level, we highlight the information/cost trade-offs required.

Starting (arbitrarily) with an exemption level of $50 million and 45,400 kilograms (100,000 pounds), total cost to industry is reduced nearly 14 percent; 10.5 percent of the chemicals may be missed entirely; approximately 15 percent of the total possible reports are exempt; and 8.6 percent of all locations are exempt. The total cost to manufacturers with annual sales under $50 million is reduced by 64 percent of the total possible cost to those manufacturers. These manufacturers account for nearly 22 percent of the total number of manufacturers used in the analysis. Reports are received from a fairly representative cross-section of sales ranges. Except for the under $100,000 ranges, over 40 percent of the locations in each range must report.

To obtain additional information, the sales parameter and/or the production parameter can be reduced. Reducing the sales parameter to $20 million picks up additional information from those locations with annual sales between $20 million and $50 million. No addition information is obtained from locations below $20 million or above $50 million. The additional information is obtained only on those chemicals produced in quantities under 45,400 kilograms (100,000 pounds). Of the 96 locations within this sales range, twenty additional locations must report when the sales parameter is lowered, and the average number of reports per location increases from 2.5 to 5.3. The percent of locations exempted drops 0.8 percent to 7.8 and the percent of reports exempted is reduced from 15 percent to 12 percent. Also, the percent of chemicals missed drops to under 8 percent from 10.5 percent. The additional cost of the information is approximately 2.5 percent of the total possible cost to industry.

The parameter should be lowered if the value of the additional information outweighs the additional burden placed on manufacturers in that sales range. The actual burden will depend on the complexity of the reporting rule and the time it takes to complete the needed forms. The value of the information depends on whether the information that would be received regarding the production of small volume chemicals at locations in this sales range varies from the information received regarding:

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[3] This result is the same as the hypothesis put forward in a previous ICF report on this topic, that marginal increases in the number of locations reporting were valued more highly than marginal increases in the number of reports prepared. See "Analysis of TSCA Section 8(a) Generic Small Manufacturer Exemption" (February 1981), p. 7 and 37.

- the production of other larger quantity chemicals by the same locations; or
- the production of the same or similar very small quantity chemicals by locations with high sales figures.

If the production process of the chemicals covered in this incremental information differ significantly from the production processes reported elsewhere, then this information may be sufficiently valuable to warrant a reduction in the sales parameter. However, of all the reports of production below 45,400 kilograms (100,000 pounds), nearly one third come from locations with annual sales greater than $50 million; and of all the locations that produce only in quantities under 45,400 kilograms, nearly one-half have annual sales greater than $50 million. Therefore, in the absence of information demonstrating that the production processes of small quantity chemicals produced by the locations in the $20 million to $50 million sales range are different from the processes of locations in the over $50 million sales range, it appears that the additional information obtained by lowering the sales parameter to $20 million may not outweigh the cost of obtaining the information.

The only remaining reason for which the value of the additional information in this example may outweigh the costs is that fewer chemicals are missed with the sales parameter at the lower level. Alternative methods of gathering information for the chemicals missed in reporting may be costly for EPA. However, as described in Chapter 3, chemicals in such small production quantities may be too unimportant to warrant detailed examination if missed in reporting. The need for Agency follow up, of course, depends on the purpose of the individual rules.

This method of analysis holds for lowering the sales parameter even below $20 million. The production processes of locations in the range under say, $5 million, may be more likely to differ from other production processes about which information is collected elsewhere. The marginal benefit of obtaining this information may be higher than the marginal benefit of obtaining the information analyzed above. It is not clear whether the benefit could be so great as to warrant a small manufacturer definition set below $5 million; in fact, it appears unlikely.

Beginning again at the $50 million, 45,400 kilogram exemption level, one can examine the benefits and costs of obtaining more information by lowering the production parameter to 4,540 kilograms (10,000 pounds). The total cost to industry increases significantly, 5 percent of the total possible cost. This entire increase is borne by locations with annual sales below $50 million. The additional information obtained is on chemicals produced in quantities between 4,540 and 45,400 kilograms. As above, if the information regarding the production of these chemicals does not differ significantly from the other information which is received, then the incremental value of this information is not very high and is unlikely to outweigh the additional costs. In other words, the primary benefit of lowering the production parameter in this way is that it increases the representativeness of the respondents; over 80 percent of the locations in each sales range would be required to report. Even if representativeness is deemed by EPA to be an important criterion, it is unlikely that it will be required to this extent even for a rule requiring a wide coverage of manufacturers.

Less information would be received if the parameters were increased. Raising the sales parameter to $100 million would reduce the total cost to industry by approximately 1.7 percent of the total possible cost of reporting. This reduction in cost would be received entirely by the locations with annual sales between $50 and $100 million. The information lost would be on those chemicals produced in quantities under 45,400 kilograms at the locations in this sales range. This information may not be very valuable for the same reasons cited above for not lowering the sales parameter to $20 million. However, the implication that the sales parameter can be increased indefinitely without the loss of any important information is not correct. As the sales parameter is increased, the information reported about chemicals in the lowest production categories (by the locations with high annual sales) is likely to become less and less representative of the information on chemicals produced in small quantities by locations with lower annual sales. Therefore, if representativeness is an important criterion, the sales parameter must be kept sufficiently low to ensure that the full range of information on low production quantity chemicals is obtained.

Just how low is "low enough" is necessarily a judgment for EPA to make. Additional information on how the production processes of the small quantity chemicals of interest vary across sales categories could be helpful. Clearly, however, there is an upper limit on the most appropriate level for the sales parameter.

Because there may always be insufficient information to choose this level with a great degree of confidence, one can examine the importance of reducing the burden on locations in the $50 to $100 million annual sales range. Increasing the sales parameter would reduce the average number of reports per location in this range by 2.0 from 5.4 to 3.4. The importance of this cost reduction to firms of this size would likely be minimal, even if the firms had as many as ten or more locations.[4] Therefore, to be conservative, it may be best to leave the sales parameter at (or below) $50 million. This will ensure sufficient information is obtained, but will probably not impose an unreasonable burden on locations with annual sales greater than this amount.

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[4] This would be more than twice the expected number of locations per firm in this sales range. See Analysis of Options for Definition of Small Business, and Estimated Cost of the Initial Section 8(a) Reporting Requirements, (EPA-561/1-77-001: November 1977), p. 45.

Less information could also be received if the production quantity parameter were increased. Increasing this parameter to 454,000 kilograms (1 million pounds) would reduce the reporting burden on those locations with annual sales under $50 million by approximately 3.6 percent of the total possible cost to industry. Only ten to thirty percent of the locations in the sales categories below $5 million would be required to report. (Over fifty percent of the locations in the other sales categories would still have to report.) This fair to low representation in the smaller sales ranges may be unacceptable for some potential future rules. This is particularly true because the incremental information foregone would be on chemicals produced in quantities up to 454,000 kilograms annually. Therefore, although the cost reduction would be received exclusively by the smaller locations (in terms of sales), it may be unwise to increase the production parameter of the one-level exemption to 454,000 kilograms.

This analysis can be repeated for additional levels of the one-level exemption. The conclusions drawn in this section reflect judgments on the relative value of obtaining different types of information from various segments of manufacturers. The next section discusses multi-level exemptions.

5.4 MULTI-LEVEL EXEMPTION

The analysis of a multi-level exemption is identical to that performed for a one-level exemption. The results will only vary insofar as the coverage required for the different reporting rules varies.

For example, a 454,000 kilogram (1 million pound) production quantity parameter may yield sufficient information for a rule that does not require broad coverage of manufacturers. With the sales parameter at $50 million, total cost to industry is reduced by approximately 17.5 percent. The entire cost reduction is received by locations with annual sales under $50 million. As mentioned in the previous section, there is only fair to low representation in the lower sales ranges at this production quantity. However, unlike the one-level exemption that must meet the constraints of the the strictest coverage requirements of potential future rules, parts of a multi-level exemption can be set higher; even a 4.54 million kilogram production quantity parameter may be acceptable.

As above, the choices of the exact levels depend on various judgments and valuations of information. Rather than repeat the lengthy example of the previous section, we may conclude that:

- The upper tiers of a multi-level exemption will be higher than the one-level exemption if the coverage required for the future rules is expected to vary;
- The total cost to industry of a series of different Section 8(a) reporting rules can be less under a multi-level exemption than under a one-level exemption; and

- If representativeness is desired, the preferred combinations of parameters at all levels is "low" production and "high" sales.

Chapter 6 summarizes the results of the analyses.

CHAPTER 6

CONCLUSIONS

In developing a general small manufacturers exemption for Section 8(a) reporting, EPA must consider a number of factors. This study was designed to help identify and analyze those factors and generally facilitate EPA's decisions regarding setting an appropriate exemption. We believe the following conclusions, important to EPA's decision, can be drawn from the analyses conducted in this study:

- The appropriate proxies to use to evaluate the amount of information received under the various Section 8(a) rules currently foreseen are the number of reports prepared and the number of locations reporting. Additionally, a measure of the representativeness of the information received from firms in the low sales ranges may be desirable (Chapter 3).

- To maximize the number of reports prepared for a given total cost to industry, "high production/low sales" parameters are preferred. To maximize the number of locations reporting for a given total cost to industry, "low production/high sales" parameters are preferred. These results are not sensitive to the relative magnitudes of the fixed and variable costs of reporting. However, these results may not hold for reporting rules for which the mix of chemicals and manufacturers are not similar to those examined here (Chapter 4).

- Nearly all production is covered in the exemption ranges examined here (Chapter 4).

- To minimize the number of chemicals missed for a given cost constraint, "high production/low sales" parameters are preferred. This result may not hold for reporting rules for which the mix of chemicals and manufacturers are not similar to those examined here (Chapter 4).

- A two-parameter exemption can more accurately target reductions in reporting costs to firms with less ability to absorb these costs (as measured by annual sales) than a one parameter exemption based on production volume. Employment is not a good substitute for annual sales as a parameter to indicate firms' abilities to absorb reporting costs. Therefore, the preferred exemption parameters are production quantity and annual sales. The preferred structure of the exemption is to require that locations be below both parameters in order to be exempted (Chapter 5).

- If production processes vary across segments of the chemical industry such that representativeness becomes an important criterion to consider, then the preferred range of exemption parameters to consider is the "low production/high sales" range This range ensures that the information obtained will be as representative as possible given the total cost to industry, and is also the cost effective range for the locations proxy. Other ranges may be equally appropriate if representativeness is deemed unimportant (Chapter 5).

- A one-level exemption is appropriate if all future rules will require approximately the same coverage of manufacturers. If coverage of manufacturers is expected to vary, then a multi-level exemption may be preferred. Given this uncertainty over future coverage requirements, the added flexibility of the multi-level exemption structure may be preferred, even if only a single level is contemplated at this time (Chapter 5).

- The choice of the exemption level requires judgments regarding the value of obtaining different types of information from various segments of the chemical industry. Additionally, the choice of exemption level distributes the total cost among the manufacturers. The actual cost imposed (in dollars) will be a function of the information requested by the reporting rule. The value of the incremental amount of information received must be balanced against the incremental cost imposed on certain segments of the industry to obtain it. Exhibit 6-1 lists six levels of the exemption in order of decreasing total cost to industry. Columns (2) and (3) show the exemption parameters. Columns (4) through (7) show the values for the cost and benefit proxies; columns (8) and (9) indicate both the representativeness of the information received and the cost imposed on the smallest manufacturers (in terms of sales). The higher the values in columns (8) and (9), the more information is required from manufacturers with annual sales below $50 million. In Chapter 5, we discuss how one can use information of the type shown in Exhibit 6-1 to identify the most appropriate level for the exemption. (Chapter 5).

EXHIBIT 6-1

COMPARISON OF THE COSTS AND BENEFITS OF SIX SMALL MANUFACTURER EXEMPTION LEVELS

(Location must be below both parameters to be exempted)

	Exemption Parameters		Percent Reduction in Proxies (%)					
Option	Sales ($) (2)	Production (kg.) (3)	Total Cost (4)	Locations (5)	Reports (6)	Chemicals (7)	Average of Percent of Locations in Sales Cate- Below $50 Million Required to Report (%) (8)	Average of Percent of Total Possible Reports from Sales Categories Below $50 Million Required to be Prepared (%) (9)
1	50 million	4,540	9.1	3.5	10.4	7.9	91.0	52.0
2	20 million	45,400	11.2	7.8	12.0	7.9	52.0[a]	27.0[a]
3	50 million	45,400	13.9	8.6	15.1	10.5	58.0	29.0
4	100 million	45,400	15.6	9.1	17.1	12.7	58.0	29.0
5	50 million	454,000	17.5	14.1	18.3	11.7	36.0	16.0
6	50 million	4.54 million	19.4	17.6	19.8	12.3	22.0	10.0

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[a] Average is for categories below $20 million in annual sales. All locations must submit all possible reports in categories between $20 million and $50 million.

APPENDIX A

DESCRIPTION OF DATA BASE

EPA provided on computer tape three files of information for this project, the Sales File, the Production File, and the Chemical File. The information was provided on a computer tape which was read into ICF's computer. The content of each of the files is described in this appendix.

Sales File

The Sales File contained ten pieces of information on 3778 manufacturing locations of 1459 chemicals. The information for each location was obtained by EPA from the Dun and Bradstreet Corporation and is as follows:

A. Manufacturer's Identification Number (MID): seven alpha-numeric characters uniquely identifying each manufacturing location. This numbering system is used by EPA.

B. DUNS Number: nine digit number uniquely identifying each manufacturing location on which the Dun and Bradstreet Corporation maintains information. Dun and Bradstreet maintains records on over 4 million businesses nationwide.

C. Headquarters DUNS (HQDUNS): if the manufacturing location is a branch that reports to a headquarters, the DUNS Number of the headquarters is reported. Also, if the location is itself a headquarters, its DUNS Number is repeated here.

D. Parent DUNS Number (PAR DUNS): if the manufacturing location is a subsidiary, the DUNS Number of its parent firm is reported here.

E. Ultimate DUNS Number (ULT DUNS): number identifying the top firm in the location's corporate structure.

F. Status: designates whether the location is a headquarters, branch, or single location.

G. Sales: the annual sales for the manufacturing location. This is not reported for branches. If the location is the top company in the corporate structure, the sales for the entire corporation is reported.

H. Subsidiary: designates whether the location is a subsidiary. All subsidiaries must have a Parent DUNS Number designated. Branch locations cannot be subsidiaries.

I. Total Employment (EMPTOTAL): total employment for the entire corporation.

J. Employment (EMPHERE): total employment for that location. This is not reported for branch locations.

The Sale File is used to associate the appropriate total employment and annual sales figures with each manufacturing location. These data are then used along with the production data to assess the extent to which each location is required to report under various small manufacturer exemptions. A significant portion of the data were missing, however. In the original data provided by EPA, there were:

- 912 locations for which the sales and employment data were completely missing because Dun and Bradstreet information was not provided;
- 1357 locations for which the sales and employment data were not provided at the corporate level; and
- 117 locations for which the sales figure was reported as zero.

This left only 1392 locations or 37 percent of the original data with sufficient information to be included in the analysis. To improve the data base, we used Standard Corporate Descriptions published by Standard and Poor's to find the annual sales and total employment of the corporations to which the locations belonged. Because the Standard and Poor's data are arranged by name, EPA provided the names of the 3778 locations as they were reported in the 1977 Inventory. Many of the names were not sufficiently specific to identify the corporation to which the location belonged (for example, many locations were listed similarly to "Plant No. 2"). We were successful in obtaining the needed sales and employment data for 455 of the 912 locations for which no Dun and Bradstreet data were provided and 55 of the 117 locations for which the sales figure was reported as zero.

For the other 1357 locations, we used a list provided by EPA of sales and employment data for approximately 925 corporations identified by Ultimate Duns Number. We successfully matched up the Ultimate Duns Numbers for 1142 of the 1357 locations which left only 215 of these locations without sales and employment data. Therefore, following our data search, the final Sales File included:

- 1392 locations: provided originally by EPA;
- 455 locations: sales and employment data found by ICF Incoroporated in Standard and Poor's;

- 55 locations: sales data found by ICF Incorporated in Standard and Poor's; and
- 1142 locations: sales and employment data found by ICF Incorporated in a printout provided by EPA.

A total of 3044 locations or 80.6 percent of the original data were used in the analysis.

Production File

The Production File contained six pieces of information on 3778 manufacturing locations. The information was provided by EPA and was developed by matching the reports of production of 1459 chemicals in the 1977 Chemical Inventory to the locations at which the production was reported as taking place. The list of 1459 chemicals chosen by EPA includes:

- all chemicals on both the ITC Initial Listing of chemicals and the 1977 Chemical Inventory; and
- chemicals being considered by EPA for the TSCA Section 8(a) Level A rule which were not chosen solely on the basis of high production quantity.

The information for each location is as follows:

A. Manufacturer's Identification Number (MID): seven digits of numbers and letters uniquely identifying each manufacturing location. This numbering system is used by EPA.

B. Mean, Standard Deviation, Low and High: derived production statistics for the manufacturing location. (These data were not used in the analyses.)

C. Blank: the number of chemicals for which that manufacturing location reported the production quantity confidential.

D. N: the number of chemicals for which that manufacturing location reported no current production, but expected future production.

E. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9: the number of chemicals for which that manufacturing location had reported production in each of ten possible production categories. The categories are as follows:

0	0 - 1,000 pounds
1	1,000 - 10,000 pounds
2	10,000 - 100,000 pounds
3	100,000 - 1 million pounds
4	1 million - 10 million pounds
5	10 million - 50 million pounds
6	50 million - 100 million pounds
7	100 million - 500 million pounds
8	500 million - 1 billion pounds
9	greater than 1 billion pounds

F. Total: total number of Inventory chemicals produced at that manufacturing location.

Chemical File

The Chemical File contains the same information as in the Production File, except the Chemical File is arranged by chemical instead of manufacturing location. The information obtained for each chemical from the 1977 Chemical Inventory is as follows:

A. CAS Number: nine digit number uniquely identifying each chemical.

B. Mean, Standard Deviation, Low and High: derived production statistics for the chemical. (These data were not used in the analyses.)

C. Blank: the number of reports of that chemical for which the production quantity was kept confidential by the manufacturer.

D. N: the number of reports of that chemical for which the manufacturing location reported no current production, but expected future production.

E. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9: the number of reports of production of that chemical in each of ten possible production categories. The ten categories are defined in the previous section on the Production File.

The Chemical File only included data on 1243 of the 1459 chemicals chosen by EPA to examine in this study. The list of 1243 was developed by EPA by choosing all those chemicals on both the 1977 Chemical Inventory and on the Interagency Testing Committee (ITC) Initial Listing of Chemicals. Data on these chemicals were provided by EPA to ICF Incorporated.

EPA then expanded the list of chemicals to include 216 additional chemicals being considered for the TSCA Section 8(a) Level A rule which were not chosen solely on the basis of high production quantity. Data on these additional chemicals were not provided. Nevertheless, the data on the 1243 chemicals are very likely to be representative of the larger list of 1459 chemicals. Additionally, the production data for these 1459 chemicals have been updated since the performance of this analysis. The updated information was also not available for the Sales and Production Files described above. The newer data would probably not affect any conclusions drawn in this report. Exhibit A-1 displays the similarity in the distributions of the reports of production across the various production categories for the two lists of chemicals, and the updated data. The distribution of reports for the expanded list was developed using the Production File data. The larger list has a slightly higher percentage of reports of production in which the production quantity was kept confidential by the manufacturer (category BLANK). The list of 1243 appears to be well representative of the larger list and is therefore used in the analysis. The distribution of reports for the updated data was provided by EPA. Again the distributions are sufficiently similar such that errors introduced by using the "old" list are likely to be insignificant. Therefore, EPA concluded that no further revisions to the analysis were necessary.

The Inventory Small Manufacturer Exemption

The initial reporting rule for the Inventory included a small manufacturer exemption of $5 million, except that no manufacturer was considered small with respect to any chemical manufactured at a location in an amount exceeding 100,000 pounds. Small manufacturers were exempted from reporting production quantities and were permitted to aggregate data from more than one manufacturing location. This small manufacturer exemption may bias the Inventory data (upon which the anayses in this report are based), and consequently may affect the results presented in the chapters above.

The data and results regarding the marginal benefits and costs of setting the exemption below both $5 million and 100,000 pounds are suspect. The greater the bias in the Inventory data (which is unknown), the more inaccurate is the information reported above on small manufacturer exemptions set below both of these levels.

The effects of a small manufacturer exemption induced bias in the Inventory data on the data and results regarding the marginal benefits and costs of setting the exemption with at least one parameter above $5 million or 100,000 pounds are negligible. The data and analysis in the report are based on the number of locations that would have to report, which was obtained directly from the data. The small manufacturer exemption in the Inventory reporting rule did not affect the accuracy of this information. In the presentation of the results, however, we used the percentage of locations not required to report. This was estimated by dividing the difference between the total number of locations and the number of locations required to report by the total. The resulting percentages are in error only to the extent that the total number of locations (which may be biased downward due to the small manufacturer exemption) is in error. All the percentages would be innaccurate, but the shape of the graphs shown in the report would remain unchanged. Therefore, given that the marginal costs and benefits are the primary important decision variables, the usefulness of the data and results in the report are not sensitive to a small manufacturer exemption induced bias in the Inventory data.

EXHIBIT A-1

COMPARISON OF THE DISTRIBUTION OF REPORTS OF PRODUCTION ACROSS THE PRODUCTION CATEGORIES FOR THE 1243 CHEMICALS IN THE CHEMICAL FILE VERSUS THE 1459 CHEMICALS INCLUDED IN THE PRODUCTION AND SALES FILES

	Percentage of Reports		
Category	List of 1243 Chemicals a/	List of 1459 Chemicals b/	Updated List of 1459 Chemicals c/
BLANK	21.1	22.1	21.7
N	10.7	11.2	11.4
0	7.6	7.8	7.7
1	5.0	5.1	5.2
2	7.6	7.7	7.5
3	9.7	9.6	9.6
4	11.0	10.8	10.6
5	10.3	9.7	9.9
6	4.9	4.6	4.7
7	9.0	8.5	8.7
8	1.7	1.6	1.6
9	1.4	1.4	1.4

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a/ Total Number of Reports = 18,363

b/ Total Number of Reports = 19,485

c/ Total Number of Reports = 19,374

APPENDIX B

DATA ANALYSES

The data analyses performed for this report are described in this appendix. Appendix A describes the Sales, Production, and Chemical data files used in the analysis. The information found by ICF Incorporated on 1652 manufacturing locations was entered manually into the computer. Following the addition of these data, the following analyses were performed:

- Merge the Sales and Production Files;
- Calculate values for the locations, reports, and production proxies from the Merged File;
- Calculate values for the cost proxy from the locations and reports proxies; and
- Estimate the percentage of chemicals missed using the Chemical File.

Each of these steps is described below.

B.1 MERGE THE SALES AND PRODUCTION FILES

The information on the Sales and Production Files was merged to create a single record for each of the 3778 manufacturing loctions in the data base. Associated with each location in the Merged File was its Manufacturer's identification number, the annual sales and total employment of its parent corporation, and the number of chemicals produced at that location in each of twelve production categories. Of the 3778 locations, 734 did not have complete sales and employment information. These locations were dropped from the data base, and were not used in the following analyses. A total of 3044 locations remained.

B.2 CALCULATE VALUES FOR THE LOCATIONS, REPORTS, AND PRODUCTION PROXIES

The Merged File was used to calculate values for the locations, reports, and production proxies for various small manufacturer exemptions. Eleven sales intervals, eight employment intervals, and the twelve available production categories were used to set various small manufacturer exemptions. These intervals are shown in Exhibit B-1. The calculations for the locations and reports proxies are described, and then the estimation of the production proxy is described.

Locations and Reports Proxies. The following procedure was used to calculate the number of locations that would have to report and the number of reports that would have to be prepared for various small manufacturer exemptions.

EXHIBIT B-1

INTERVALS OF THE PARAMETERS USED TO SET VARIOUS SMALL MANUFACTURER DEFINITIONS

Production Quantity kg. (lb.)		Annual Sales (millions of dollars)		Total Employment	
Category	Interval	Category	Interval	Category	Interval
0:	0-454 (0-1000)	1:	0-.10	1:	1-4
1:	454-4,540 (1000-10,000)	2:	.10-.50	2:	5-6
2:	4,540-45,400 (10,000-100,000)	3:	.50-1.0	3:	7-10
3:	45,400-454,000 (100,000-1 million)	4:	1.0-2.5	4:	11-20
4:	454,000-4.54 million (1 million-10 million)	5:	2.5-5.0	5:	21-50
5:	4.54 million-22.7 million (10 million-50 million)	6:	5.0-10	6:	51-100
6:	22.7 million-45.4 million (50 million-100 million)	7:	10-20	7:	101-200
7:	45.4 million-227 million (100 million-500 million)	8:	20-30	8:	greater than 200
8:	227 million-454 million (500 million-1 billion)	9:	30-50		
9:	Greater than 454 million (greater than 1 billion)	10:	50-100		
BLANK:	Quantity Held Confidential	11:	Greater than 100		
N:	None Produced in 1977				

1. Examine the sales and employment figures for the location and assign the location to the proper sales and employment intervals.

2. Each sales and employment interval is a vector with twelve variables. Each of the twelve variables is assigned to one of the twelve production categories. The number of reports that the location would have to prepare if the definition were set at production category 9 (i.e., the highest production category), is added to the tenth variable in the appropriate sales and employment vectors. The number of reports that the site would have to prepare if the definition were set at production category 8 is added to the ninth variable in the appropriate sales and employment vectors, and so on. The result is a matrix that identifies how many reports would have to be prepared for all the possible levels of sales and employment when production varies from categories 0 through 9 (see Exhibit B-1).

3. The same procedure was used to calculate the number of locations that would have to report for various definitions.

4. A significant number of reports of production were reported in production categories BLANK and N (33 percent of the total). It is not possible to determine whether these reports would be prepared for a given small manufacturer exemption. Therefore, they were excluded from the analysis at this stage. The total number of reports dropped from 19,485 to 15,416. Also, a significant number of locations had reported only in categories N and BLANK. It is also not possible to determine whether these locations would have to report for a given small manufacturer exemption. Therefore, these locations were dropped from the analysis at this stage. The total number of locations dropped from 3044 to 2386.

The matrices developed in the preceeding four steps are sufficient to count up the number of reports prepared and the number of locations reporting for small manufacturer exemptions with sales and production parameters, employment and production parameters, and when locations need be below both or only one parameter to be exempted. The "percent of information missing" was calculated by dividing the numbers by their appropriate totals, subtracting from one and multiplying by 100.

The values for the locations and reports proxies are reported in Chapter 4.

Production Proxy. Unlike the number of locations reporting and the number of reports prepared, the percentage of total production exempted is an estimate, because the actual production at each site is not known; only the production range is known. The range is identified by the production category in which the chemical was reported. Therefore, this proxy is estimated differently than the other proxies which are actual counts of locations and reports.

The percentage of total production exempted from reporting was be constructed in three steps:

- Estimate total production, call this quantity T;
- Estimate production exempted under a given small manufacturer definition, call this quantity E; and
- Use the above to estimate the percentage of total production exempted, call this quantity P which is a function of T and E.

Each of the three steps is discussed below.

Estimate the Total Production, T. The estimate of total production includes only those reports of production in production categories 0 through 9 (see Exhibit B-1). The production quantities of chemicals whose production quantities were kept confidential by the manufacturing locations and the production quantities of chemicals reported as not produced in 1977 when the inventory data were collected (but were produced prior to 1977 and were expected to be produced in the future) cannot be used because there are no production statistics available for them.

Both gross total production and total production were estimated. The gross total production, call it GT, includes all the reports of production (in categories 0 through 9) of all the manufacturing sites on which production information was provided by EPA. The total production, T, includes only those manufacturing sites for which all necessary sales and employment data are available. Total production, T, as a percentage of gross total production, GT, was estimated to indicate the extent to which missing sales and employment data reduce the coverage of the data base. (The method for estimating this percentage is described below.)

Total production, T, and gross total production, GT, were estimated in the same way, except that fewer sites were used in estimating total production. Total production, T, was used to estimate the percentage of production exempted by various definitions. The following explains how total production was estimated.

All manufacturing locations for which sales and/or employment information was missing were removed from the Merged File. For the remaining locations, the number of reports of production in each of the ten production categories were counted. The result, the total number of chemicals produced in each category, was called COUNT; COUNT_0 equals the number of reports of production in production category 0, COUNT_1 equals the number of reports of production in production category 1, and so on.

For each production category, EPA estimated the mean and standard deviation of production. The list of means for the production categories was put in a vector called MEAN, and the list of standard deviations was used to construct a vector called VAR, for variance.

Each production category also has high and low bounds of production. For example, production category 1 goes from 1000 pounds to 10,000 pounds. These values were put in two vectors called MAX and MIN.

The following operations were done to estimate total production:

(1) $$\text{Total Production} = T = \sum_{i=0}^{9} \text{COUNT}_i \times \text{MEAN}_i$$

(2) $$\text{Variance of } T = VT = \sum_{i=0}^{9} \text{COUNT}_i \times \text{VAR}_i$$

(3) $$\text{Minimum possible value for } T = \text{MINT} = \sum_{i=0}^{9} \text{COUNT}_i \times \text{MIN}_i$$

(4) $$\text{Maximum possible value for } T = \text{MAXT} = \sum_{i=0}^{9} \text{COUNT}_i \times \text{MAX}_i$$

(5) $$\text{Likely lowest value for } T \text{ given } VT = \text{LOWT} = T - 1.96 \times [VT]^{1/2}$$

(6) $$\text{Likely highest value for } T \text{ given } VT = \text{HIGHT} = T + 1.96 \times [VT]^{1/2}$$

Total production is estimated by T with a standard deviation equal to the square root of VT. The likely range of T goes from the greater of MINT and LOWT to the lesser of MAXT and HIGHT.

Estimate Exempted Production, E. Exempted production was estimated the same way as total production. Only the reports of production of those manufacturing sites exempted under the definition being examined were included. Only the COUNT vector changes; and for exempted production, this vector will be renamed to COUNTE. The vectors MEAN, VAR, MIN, and MAX remain unchanged.

Exempted production is estimated by E with a standard deviation equal to the square root of VE. The likely range of E goes from the greater of MINE and LOWE to the lesser of MAXE and HIGHE. These values are estimated as shown in equations (1) through (6); T changes to E, VT changes to VE, MINT changes to MINE, MAXT changes to MAXE, LOWT changes to LOWE, HIGHT changes to HIGHE, and COUNT changes to COUNTE.

Estimate the Percentage of Total Production Exempted. There are no simple exact formulae for the mean and variance of the ratio of two random variables. The following approximations are taken from Mood, Graybill, and Boes:[1]

$$(7) \qquad \varepsilon\left(\frac{X}{Y}\right) = \frac{\mu x}{\mu y} - \frac{1}{\mu y^2}\,\mathrm{COV}\,[X,Y] + \frac{\mu x}{\mu y^3}\,\mathrm{VAR}\,[Y],$$

$$(8) \qquad \mathrm{VAR}\,\frac{X}{Y} = \left(\frac{\mu x}{\mu y}\right)^2 \left(\frac{\mathrm{Var}\,[X]}{\mu x^2} + \frac{\mathrm{VAR}[Y]}{\mu y^2} - \frac{2\,\mathrm{COV}[X,Y]}{(\mu x)\,(\mu y)}\right)$$

In our application, $E = \mu x$, $VE = VAR[X]$, $T = \mu y$, and $VT = VAR[Y]$. If T and E are independent, then $COV[E,T] = 0$ and all the terms in equations (7) and (8) are specified. However, T and E are not independent because T is actually comprised of the sum of an estimate of E, the exempted production, and an estimate of the non-exempted production, call it N. By this definition, the expected value of T equals the expected value of E + N, where E and N are independent. Therefore, the COV[E,T] can be written as:

$$(9) \quad \mathrm{COV}[E,T] = \mathrm{COV}(E, E+N), \text{ and simplifying:}$$

$$\mathrm{COV}[E,T] = \varepsilon(E^2) + \varepsilon(EN) - [\varepsilon(E)]^2 - \varepsilon(E)\,\varepsilon(N)$$

$$\mathrm{COV}[E,T] = \varepsilon(E^2) - [\varepsilon(E)]^2$$

$$(10) \quad \mathrm{COV}[E,T] = \mathrm{VAR}(E) = VE$$

This result in equation (10) can be substituted into equations (7) and (8) to complete the formulae:

$$(11) \qquad P = \varepsilon\left(\frac{E}{T}\right) = \frac{E}{T} - \frac{1}{T^2}\,VE + \frac{E}{T^3}\,VT, \text{ and}$$

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[1] Alexander Mood, Franklin Graybill, and Duane Boes, Introduction to the Theory of Statistics (New York: McGraw/Hill Publishing Company, 1974), pp. 180-181.

$$(12)\quad VP = VAR\left(\frac{E}{T}\right) = \left(\frac{E}{T}\right)^2 \left(\frac{VE}{E^2} + \frac{VT}{T^2} - \frac{2\ VE}{ET}\right), \text{ where}$$

P equals the percentage of total production exempted and VP equals the variance of the estimate P. The likely range for P can be estimated by:

$$(13)\ LOWP = P - 1.96\ [VP]^{1/2}$$

$$(14)\ HIGHP = P + 1.96\ [VP]^{1/2}$$

The range calculated in equations (13) and (14) were used unless the values fall outside the minimum and maximum possible values which are defined by:

$$(15)\qquad MINP = \frac{\text{Lower Bound for E}}{\text{Upper Bound for T}}$$

$$(16)\qquad MAXP = \frac{\text{Upper Bound for E}}{\text{Lower Bound for T}}$$

The upper and lower bounds for E and T are found with equations (3) through (6) as explained above. The greater of LOWP and MINP and the lesser of HIGHP and MAXP is the appropriate range.

These calculations result in an estimate of the percentage of total production exempted by a given small manufacturer definition and estimates of the likely bounds on the percentage. Values for this proxy are reported in Chapter 4.

B.3 CALCULATE VALUES FOR THE COST PROXY

The cost proxy is the sum of the number of reports prepared and the number of locations required to report. These values were calculated for the reports and locations proxies. To calculate the percent reduction in total cost to industry for a given exemption, we divided the sum of the number of reports required to be prepared plus the number of locations reporting by the total possible number of locations and reports. This fraction was subtracted from one and multiplied by 100 to get the percent reduction in total cost to industry. These values are reported in Chapter 4.

B.4 ESTIMATE PERCENTAGE OF CHEMICALS MISSED

To identify those chemicals about which no information would be reported under various small manufacturer exemptions, the list of chemicals that each manufacturer produces, and the quantities in which each manufacturer produces them is required. With these data, one could keep track of which locations must report which chemicals under each exemption level, and for each exemption level, the chemicals for which no reports are required could be identified. However, these data were not available for this report. Therefore, a simulation was run to estimate, on an expected value basis, the percentage of chemicals that would be missed under various small manufacturer exemptions.

A simulation is an attempt to reproduce a complex system of relationships in what is the equivalent of a laboratory setting.[2] The system, generally expressed as a series of equations, is analyzed in a systematic and reproducible manner. A simulation was developed using the Chemical File and some statistics from the Merged File to examine the relationship between the number of different chemicals not reported and the levels of the small manufacturer exemption.

The Merged File was used to estimte the distribution of reports of production across the sales and employment categories. For example, of the 770 reports of production in production category 7, 10 percent come from locations in sales category 6. (See Exhibit B-1 for the definitions of the categories.) Therefore, knowing nothing about the report of production other than its production category, one can assign probabilities for the sales and employment categories of the locations from which the report may have come from. Given these probabilities, the Chemical File was used to estimate whether each of a random selection of chemicals would be missed for a certain small manufacturer exemption. This was determined as follows:

1. Examine the reports of production for that chemical. For each report of production listed, generate a random number. Apply each of the random numbers to the appropriate lists of probabilities to see which "locations" most likely produce that chemical. The actual locations at which the chemical is produced are not identified, but the sales and employment ranges in which the producers of that chemical are likely to fall are estimated. The highest production category in which the chemical is produced can be read directly from the data.

2. The highest sales and employment categories simulated for that chemical are stored. These values can be used to determine under which exemption the chemical would not be reported at all. The chemical is not reported if both the sales and production quantity parameters of the exemption exceed the highest sales and production quantity values stored for that chemical. (If total employment is substituted for sales, then the chemical is not reported if both the employment and production quantity parameters of the exemption exceed the highest employment and production quantity values stored for that chemical.)

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[2] Edith Stokey and Richard Zeckhauser, A Primer for Policy Analysis (New York: W.W. Norton and Company, Incorporated, 1978), p. 89-90.

Once this is done for all the chemicals, the number of chemicals missed under each exemption level can be counted. The results will vary, however, depending on how the randoms number come up. Therefore, we ran the simulation thirty times, each time randomly choosing 250 different chemicals from the list of 1243. Thirty trials are statistically sufficient to ensure unbiased expected values for the average number of chemicals missed under the various small manufacturer exemptions. Samples of 250 chemicals for each trial were believed to be sufficiently large to ensure representative results for the entire list of chemicals.

The average percent of chemicals missed, of those reported in production ranges 0 through 9, is reported for each level of the exemption in Chapter 4. Exhibits B-2 and B-3 display not only the average percent of chemicals missed, but also the highest and lowest percent missed in the thirty trials of the simulation. The range is fairly large, demonstrating the wide range of possible outcomes.

Estimates of the lower bound of the percentage of chemicals that would be missed for the case where the location need only be below one parameter to be exempted are presented in Exhibit 4-28 in Chapter 4. The lower bounds were constructed by calculating the percentage of chemicals whose highest report of production is in each of the ten production categories 0 through 9. All the chemicals whose highest report of production is in category 0 would be missed if the production parameter were set at or above production category 1. Similarly, all the chemicals whose highest report of production is in category 1 would be missed if the production parameter were set at or above production category 2, and so on. Exhibit 4-28 shows that even without taking into account locations exempted due to sales, a large portion of the chemicals would be missed, even for very low exemption levels, when locations need only be below one parameter to be exempted. Therefore, a simulation was not developed to "fine tune" the estimates of chemicals missed for this type of exemption.

Approximately 18 percent of the chemicals were reported only in production categories BLANK and/or N. It was not possible to determine whether they would be missed under various small manufacturer exemptions, and they were therefore excluded from this analysis. If these chemicals are distributed across the production and sales categories in the same manner as the other chemicals, then the results are generalizable to them. The reslts may not be applicable for groups of chemicals unlike those in the data base, however.

EXHIBIT B-2

LOWEST, AVERAGE, AND HIGHEST PERCENTAGE OF CHEMICALS MISSED FOR THIRTY SIMULATION TRIALS
SALES AND PRODUCTION QUANTITY PARAMETERS

(Location must be below both parameters to be exempted)

Production Categories	Sales Categories 1	2	3	4	5	6	7	8	9	10	11
PV0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PV1	0.0	0.0	0.0	0.0	0.0	0.0	1.005	1.005	1.005	1.508	3.015
	0.0	0.0	0.379	1.658	1.954	2.533	3.835	4.090	5.165	5.447	6.297
	0.0	0.0	1.571	3.382	4.831	5.797	9.662	10.145	12.077	12.560	13.527
PV2	0.0	0.0	0.0	0.0	0.485	0.971	2.404	3.015	3.015	4.523	6.030
	0.0	0.0	0.463	1.874	2.629	3.700	5.479	5.952	7.203	7.897	9.054
	0.0	0.0	1.571	3.590	4.831	7.000	10.628	11.111	13.043	14.493	15.942
PV3	0.0	0.0	0.0	0.0	0.971	2.404	3.922	3.922	4.523	5.882	8.995
	0.0	0.016	0.329	2.221	3.256	4.921	7.142	7.954	9.499	10.521	12.740
	0.0	0.474	1.571	4.103	5.641	8.500	12.077	13.043	15.459	17.391	19.807
PV4	0.0	0.0	0.0	0.0	0.971	2.427	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.304	3.435	5.398	7.750	8.759	10.519	11.724	14.399
	0.0	0.474	1.571	4.615	6.154	9.500	12.550	13.527	15.942	17.374	20.773
PV5	0.0	0.0	0.0	0.0	0.971	2.451	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.337	3.485	5.575	8.057	9.132	10.975	12.259	15.049
	0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493	17.391	19.324	22.222
PV6	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.214	11.073	12.356	15.152
	0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493	17.391	19.324	22.222
PV7	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.231	11.090	12.373	15.227
	0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493	17.391	19.324	22.222
PV8	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.231	11.090	12.373	15.227
	0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493	17.391	19.324	22.222
PV9	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922	5.882	5.882	9.524
	0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.231	11.090	12.373	15.227
	0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493	17.391	19.324	22.222

EXHIBIT B-3

LOWEST, AVERAGE, AND HIGHEST PERCENTAGE OF CHEMICALS MISSED FOR THIRTY SIMULATION TRIALS
EMPLOYMENT AND PRODUCTION QUANTITY PARAMETERS
(Location must be below both parameters to be exempted)

		Employment Categories							
		1	2	3	4	5	6	7	8
Production Categories	PV0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PV1	0.0	0.0	0.0	0.0	0.0	0.0	1.005	1.005
		0.0	0.0	0.379	1.658	1.954	2.533	3.835	4.080
		0.0	0.0	1.571	3.382	4.331	5.797	9.652	13.145
	PV2	0.0	0.0	0.0	0.0	0.485	0.971	2.404	3.015
		0.0	0.0	0.463	1.674	2.629	3.700	5.479	5.952
		0.0	0.0	1.571	3.590	4.831	7.000	10.628	11.111
	PV3	0.0	0.0	0.0	0.0	0.971	2.404	3.922	3.922
		0.0	0.016	0.529	2.221	3.256	4.921	7.142	7.954
		0.0	0.474	1.571	4.103	5.641	8.500	12.077	13.043
	PV4	0.0	0.0	0.0	0.0	0.971	2.427	3.922	3.922
		0.0	0.016	0.546	2.304	3.435	5.398	7.750	8.759
		0.0	0.474	1.571	4.615	6.154	9.500	12.560	13.527
	PV5	0.0	0.0	0.0	0.0	0.971	2.451	3.922	3.922
		0.0	0.016	0.546	2.337	3.485	5.575	8.057	9.132
		0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493
	PV6	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922
		0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.214
		0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493
	PV7	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922
		0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.231
		0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493
	PV8	0.0	0.0	0.0	0.481	1.442	2.451	3.922	3.922
		0.0	0.016	0.546	2.353	3.518	5.608	8.123	9.231
		0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493
	PV9	0.0	0.0	0.0	0.461	1.442	2.451	3.922	3.922
		0.0	0.016	0.546	2.353	3.518	5.609	9.123	9.231
		0.0	0.474	1.571	4.615	6.154	9.500	13.527	14.493

APPENDIX C

ANALYSIS OF A HYPOTHETICAL REPORTING RULE

The purpose of this appendix is to demonstrate that the conclusions regarding the most cost-effective small manufacturer definition developed in this report are not necessarily generalizable to all reporting rules. We demonstrate this through the construction of a hypothetical reporting rule in which the conclusions would not hold, thereby proving that they do not hold for all reporting rules.

Our hypothetical reporting rule covers 7 locations, which generate 18 reports among them. Each point on Exhibit C-1 represents one of those reports. The location at sales level A must submit reports on 5 substances, whose production volumes are distributed as shown, and the other reports are distributed among the six remaining firms. Assuming that firms must meet both sales and production criteria to qualify as a small manufacturer, two location isoquants and one report isoquant are shown.

In order to interpret the effect of a particular pair of sales and production criteria, form an ordered pair of the two criteria and locate the point on the graph. If it is below and to the left of the L = 7 isoquant, all seven locations are included under those criteria. If the point lies between the L = 7 and L = 6 isoquants, six locations are included under those criteria. If the point is below and to the left of the R = 14 isoquant, at least 14 reports are received under these criteria.

In our study, we found the cost-effective solution, when the firm must meet both criteria and the number of reports is the measure of information, to be in the "southeast" corner of the graph, no matter what the relative coefficient values. But this is not the case here. Setting $\underline{a} = 0$ in the cost equation, as $\underline{b}$ increases in size relative to $\underline{c}$, the cost isoquants approximate the location isoquants more and more closely. If the cost isoquants were equal to the location isoquants, and at least 14 reports were required, the cost minimizing solution would fall in the shaded area in the center, rather than in the "southeast" corner. Therefore, for some values of $\underline{b}$ sufficiently large in relation to $\underline{c}$, the cost-effective solution is in the center.

EXHIBIT C-1a

HYPOTHETICAL EXAMPLE OF REPORTING RULE IN WHICH COST-EFFECTIVE SOLUTION DOES NOT LIE IN THE "SOUTHEAST" CORNER WHEN REPORTS ARE USED AS A PROXY FOR INFORMATION

(Firm must be below both parameters to be exempt)